LIBRARY
MAY 31 1972
PACIFIC POWER & LIGHT COMPANY

U.S. DEPARTMENT OF THE INTERIOR

OFFICE OF WATER RESOURCES RESEARCH
WATER RESOURCES SCIENTIFIC INFORMATION CENTER

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 5, NUMBER 9
MAY 1, 1972

W72-04704 --W72-05278

SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information are now provided by NTIS.

SELECTED WATER RESOURCES ABSTRACTS is available to Federal agencies, contractors, or grantees in water resources upon request to: Manager, Water Resources Scientific Information Center, Office of Water Resources Research, U.S. Department of the Interior, Washington, D. C. 20240.

SELECTED WATER RESOURCES ABSTRACTS is also available on subscription from the National Technical Information Service. Annual subscription is $22 (domestic), $27.50 (foreign), single copy price $3. Certain documents abstracted in this journal can be purchased from the NTIS at prices indicated in the entry. Prepayment is required.

LIBRARY
MAY 21 1972
PACIFIC POWER & LIGHT
COMPANY

SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

VOLUME 5, NUMBER 9
MAY 1, 1972

W72-04704 --W72-05278

Use of funds for printing this publication approved by the Director of the Bureau of the Budget, September 4, 1968.

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the

Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

CONTENTS

FOREWORD iii

SUBJECT FIELDS AND GROUPS

(Use Edge Index on back cover to Locate Subject Fields and Indexes in the journal.)

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Non-Water Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

02. WATER CYCLE

2A. General

DETECTION OF A CHANGE IN RUNOFF BY AN ANALYSIS OF DAILY FLOWS,
Department of Natural Resources, Quebec.
A. J. Dumas, and H. J. Morel-Seytoux.
International Association of Scientific Hydrology Bulletin, Vol 16, No 1, p 69-87, March 1971. 5 fig, 6 tab, 9 ref. Bur Reclam 14-06-D-6597.

Descriptors: *Streamflow forecasting, *Statistical methods, *Time series analysis, Regression analysis, Statistical models, Variability, Runoff forecasting, Stochastic processes, Correlation analysis, Cloud seeding.
Identifiers: Daily flow analysis.

A technique was developed for rapid detection of the occurrence of a suspected hydrologic change due to seeding of clouds over high mountain watersheds. The method uses a sequence of independent daily flows. This procedure is superior to previous ones based on seasonal or yearly flows. The use of daily, instead of seasonal flow, data in a Student t-test reduces the number of necessary years of data by an average of three for the 20 cases. All of the cases are from the Upper Colorado River Basin. The statistical procedure of detection relies on the Target Control concept and the application of a conditional Student t-test, which is a test of the difference between Target and Control for the seeded and non-seeded periods. (Knapp-USGS)
W-72 04846

RELATION OF PONDED FLOODWATER FROM HURRICANE BEULAH TO GROUND WATER IN KLEBERG, KENEDY, AND WILLACY COUNTIES, TEXAS,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 02F.
W72-04796

RAINFALL AND RUN-OFF FROM AN INDUSTRIAL AREA IN NAIROBI, KENYA,
Road Research Lab. Crowthorne (England).
For primary bibliographic entry see Field 04C.
W72-04837

RUNOFF FROM IMPERVIOUS SURFACES,
Kansas Univ., Lawrence. Dept. of Mechanics and Aerospace Engineering.
For primary bibliographic entry see Field 04C.
W72-04844

PROBLEMS RAISED BY THE APPLICATION OF STOCHASTIC RELATIONS TO HYDROLOGIC VARIABLES AND MEANS OF THEIR SOLUTION (PROBLEMES SOULEVES PAR L' APPLICATION DES RELATIONS STOCHASTIQUES AUX VARIABLES HYDROLOGIQUES ET MOYENS DE LES RESOUDRE),
Grenoble Univ. (France). Laboratoires de Mecanique des Fluides.
M. Rosenberg.
International Association of Scientific Hydrology Bulletin, Vol 16, No 1, p 59-68, March 1971. 1 fig, 1 tab, 14 ref.

Descriptors: *Rainfall-runoff relationships, *Stochastic processes, *Regression analysis, Model studies, Statistical models, Data collections, Data processing, Statistics, Hydrologic data.
Identifiers: Israel.

Multiple regression and correlation analysis were used to analyze the hydropluvial relations for yearly and monthly series for 24 rivers and wadis in Israel. In spite of the extremely weak annual flow coefficient of 1 to 5% of most of the streams under study, successful coefficients of multiple correlations vary, for most of the streams, between 0.96 and 0.99. A regional model explains the areal distribution of the mean annual precipitation as a function of climatic and morphologic factors. (Knapp-USGS)
W72-04847

CARTRIDGE MAGNETIC TAPE INCREMENTAL RECORDER FOR HYDRO-METEOROLOGICAL DATA ACQUISITION,
Padua Univ. (Italy). Istituto di Elettrotecnica e di Elettronica; and Centro Veneto di Richerche Idrauliche, Padua (Italy).
For primary bibliographic entry see Field 07A.
W72-04848

WATER BALANCE AND REGIONALIZATION OF DRAINAGE IN THE TURKMEN SSR (VODNYY BALANS I RAYONIROVANIYE DRENAZHA V TURKMENSKOY SSR),
Desert Inst., Ashkhabad (USSR).
For primary bibliographic entry see Field 04A.
W72-04861

A MODULAR DISTRIBUTED MODEL OF CATCHMENT DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 02E.
W72-04896

HYMO, A PROBLEM-ORIENTED COMPUTER LANGUAGE FOR BUILDING HYDROLOGIC MODELS,
Agricultural Research Service, Riesel, Tex. Soil and Water Research Div.
For primary bibliographic entry see Field 07C.
W72-05028

EFFECTS OF RANDOM DATA ERRORS ON THE PARAMETER VALUES FOR A CONCEPTUAL MODEL,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
For primary bibliographic entry see Field 07A.
W72-05029

STOCHASTIC MODELING OF TEMPERATURE AND FLOW IN RIVERS,
Carnegie-Mellon Univ., Pittsburgh, Pa. Div. of Sponsored Research.
F. C. McMichael, and J. S. Hunter.
Water Resources Research, Vol 8, No 1, p 87-98, February 1972. 12 fig, 2 tab, 9 ref. Supported by American Iron and Steel Institute.

Descriptors: *Time series analysis, *Stochastic processes, *Statistical models, *Water temperature, Discharge (Water), *Streamflow forecasting, Simulation analysis, Synthetic hydrology, Mathematical models.
Identifiers: *Stochastic models.

Forecast models using historical time series data for temperature and flow may be constructed by means of parametric time series models. The new methods and two examples of data illustrative of the iterative procedures necessary to construct a good forecast model are given. The daily water temperature and Ohio River discharge at Wheeling, West Virginia, for January 1, 1963-December 31, 1968, provide the raw material for the models. The methods are easily extended to other problems. (Knapp-USGS)
W72-05030

GROUNDWATER FLOW IN A SANDY TIDAL BEACH: TWO-DIMENSIONAL FINITE ELEMENT ANALYSIS,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 02F.
W72-05033

SOME RESULTS OF HYDROMTEOROLOGICAL RESEARCH WORK CARRIED OUT IN THE EXPERIMENTAL BASINS OF THE METEOROLOGICAL SERVICE OF GERMAN DEMOCRATIC REPUBLIC,
Meteorologischer Dienst der Deutschen Demokratischen Republik, Berlin. Forschungsinstitut fuer Hydrometeorologie.
D. Schumann.
International Association of Scientific Hydrology Bulletin, Vol 16, No 2, p 41-51, June 1971. 1 fig, 2 tab, 14 ref.

Descriptors: *Water balance, *Meteorology, *Data collections, Surveys, Evapotranspiration, Precipitation (Atmospheric), Rainfall, Snowmelt, Heat balance, Rainfall-runoff relationships.
Identifiers: German Democratic Republic.

Hydrometeorological investigations are carried out by the Meteorological Service of the German Democratic Republic in four experimental basins with different altitudes, surface areas, and physico-geographical features. This research work is predominantly for exploration of the water balance, including the possibilities of extending the results by way of extrapolation to larger areas; setting up, verification, and improvement of methods for determining the individual components of the water balance, especially precipitation and evapotranspiration; and for obtaining increased knowledge of heat and water balance of the snow cover. (Knapp-USGS)
W72-05046

THE USE OF NON-DIMENSIONAL ONE--PARAMETER FUNCTIONS FOR THE DETERMINATION OF REGIONAL RAINFALL DEPTH--DURATION-FREQUENCY RELATIONS,
Water Planning for Israel Ltd, Tel Aviv (Israel).
S. Dalinsky.
International Association of Scientific Hydrology Bulletin, Vol 16, No 2, p 67-79, June 1971. 3 fig, 6 tab, 5 ref.

Descriptors: *Depth-area-duration analysis, *Distribution patterns, Runoff forecasting, Streamflow forecasting, Meteorology, Statistical methods, Rain gages, Data collections, Climatology.
Identifiers: Israel.

Depth-duration relations of regional rainfall, up to a duration of one day (24 hours), can be expressed by a simple non dimensional exponential function of one parameter. In all cases analyzed, the value of n, an exponent, which characterizes the rainfall distribution, was smaller than or equal to 1/2. When rainfall depths of long durations (of more than one hour) were significant, the exponent n=1/2 was found suitable; when they become less significant where greater importance is attached to short-duration rainfall, the value is decreased. The formula was applicable to regional descriptions in the U.S.A. and Israel. The formula was not applicable to a regional description of short-duration rainfall (of up to one hour); short rainfall intensities were found to have a largely identical distribution with regard to relative depth-duration relations. For planning and for other purposes it is possible in all cases for all rainfall distributions to use uniform return period (frequency) coefficients which fit the log-normal distribution. Rainfall data of Israel are used to illustrate the analysis and the findings are compared to those of the U.S.A. (Knapp-USGS)
W72-05047

NEW LANDMARK IN THE WHITE MOUNTAINS,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
C. A. Federer.
Appalachia, p 586-594, December 1969. 5 fig.

Descriptors: *Clear-cutting, *Hydrologic cycle, *Herbicides, *Canopy, *Transpiration, *Evaporation, *Streamflow, *Snowmelt, Percolation, Stream gages, Rain ages, Erosion, New Hampshire.
Identifiers: *NEW Landmark, *New England watershed history, *Streamflow distribution, Gaged watersheds, Nutrient budget, Interception of rain and snow, Soil water movement, Hubbard Brook Experimental Forest (NH).

Research studies at the Hubbard Brook Experimental Forest in central New Hampshire are aimed at explaining the complicated pathways water takes from the time it lands on the forest as rain or snow until it leaves as either streamflow or evaporation. At the same time the scientists are learning how a forest influences the water cycle, they are gaining knowledge needed for managing the forest to maintain and enhance its watershed values. Watershed 3 is the first of eight drainage areas to be treated. The treatment was designed as an extreme alteration of the vegetative cover on the land area. Watershed research in New England's White Mountains dates back to 1911 and 1912, after passage of the Week's Act. This paper gives a brief history of watershed research in the White Mountains and describes work that is presently underway at Hubbard Brook. (Reeves-Forest Service)
W72-05080

HYDRODYNAMIC DISPERSION IN AGGREGATED MEDIA: 1. THEORY,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
For primary bibliographic entry see Field 02G.
W72-05122

2B. Precipitation

DEVELOPMENT OF A PROCEDURE FOR DETERMINING SPACIAL AND TIME VARIATIONS OF PRECIPITATION IN VENEZUELA,
Utah State Univ., Logan. Coll. of Engineering.
L. E. Ramirez.
Utah Water Research Laboratory Report PRWG69-3, May 1971. 92 p, 6 fig, 3 tab, 27 ref, 4 append. Contract AID/csd-2167.

Descriptors: *Precipitation (Atmospheric), *Time series analysis, *Meteorological data, *Data collections, Forecasting, Computer models, Estimating, Climatology, Statistical methods, Hydrologic data, Analytical techniques, Frequency analysis.
Identifiers: *Venezuela.

An analysis of the influence of length of record on the reliability of mean values of precipitation was made for Caracas-Cagigal Station in Venezuela. Ten series of values were obtained for 10, 15, 20, 25, 30, and 35-year periods, extracted for sliding intervals for the overall record of 75 years. The reliability of mean values computed was quite low for 10, 15, and 20-year periods. The long term record means had higher reliability, increasing with the number of years in the record, but the differences are not important in terms of accuracy. Precipitation values for 0.5, .10, .20, .30, .40, .50, .60, .70, .80, .90, and .95 equal or less probability levels were computed based on gamma distribution for 126 stations distributed throughout Venezuela. Computer programs were used to process the data. (Woodard-USGS)
W72-04804

ANALYSIS OF COLOMBIAN PRECIPITATION TO ESTIMATE IRRIGATION REQUIREMENTS,
Utah State Univ., Logan. Coll. of Engineering.
J. E. Hardee.
Utah Water Research Laboratory Report PRWG69-4, May 1971. 67 p, 5 fig, 9 tab, 35 ref, 4 append. Contract AID/csd-2459 and AID/csd-2167.

Descriptors: *Precipitation (Atmospheric), *Irrigation water, *Water yield, *Hydrologic data, Data collections, Estimating, Forecasting, Analytical techniques, Hydrologic budget, Water balance, Climatology, Meteorological data, Computer models, Irrigation programs, Statistical methods, Frequency analysis.
Identifiers: *Republic of Columbia.

A computer program was developed to calculate monthly and annual gamma distributions from recorded data for 97 stations throughout the Republic of Colombia, South America. For each station 13 probability levels of precipitation were determined. Each precipitation amount is that which is expected to be equalled or exceeded at the given probability level. Climatological data previously recorded for 43 of these stations were used to calculate potential evapotranspiration using the Christiansen and Hargreaves formula. For these stations the precipitation from the gamma distribution at five probability levels was subtracted from the potential evapotranspiration to arrive at potential irrigation requirements. Estimates of precipitation probability are used in solving many problems in engineering and agriculture. For irrigation, drainage and hydraulic structure designs probabilities and their associated risks are essential for economic analysis. In experimental work the normalcy of the experimental period can be determined. The wide range of probabilities offers a basic design tool from which rational conclusions can be made. The irrigation requirements presented provide a useful index of actual irrigation requirements. (Woodard-USGS)
W72-04806

DEVELOPMENT OF COLD CLOUD SEEDING TECHNOLOGY FOR USE IN PRECIPITATION MANAGEMENT,
Utah State Univ., Logan. Coll. of Engineering.
For primary bibliographic entry see Field 03B.
W72-04836

SNOWFALL FROM LAKE-EFFECT STORMS,
State Univ., Albany, New York.
J. E. Jiusto, and M. L. Kaplan.
Monthly Weather Review, Vol 100, No 1, p 62-66, January 1972. 4 fig, 5 tab, 8 ref. NOAA Grant E22-13-69 (G).

Descriptors: *Snowfall, *Great Lakes, *Storms, Climatology, Meteorology, Great Lakes region, Snow, Weather, Weather patterns, Distribution patterns.
Identifiers: *Lake-effect snowstorms.

Three yr of winter lake-storm data were analyzed to determine snowfall distribution patterns downwind of Lake Erie and Lake Ontario. The total amount of snowfall and the area of ground covered in each of 23 lake-effect storms were determined for both lakes. Total snowfall mass was highly dependent on time of year; November and early December storms were two to five times more productive than January storms. A considerable variation in snow density (snowfall depth to melt water ratio) could be attributed mainly to differences in snow crystal type. (Knapp-USGS)
W72-04845

CARTRIDGE MAGNETIC TAPE INCREMENTAL RECORDER FOR HYDRO-METEOROLOGICAL DATA ACQUISITION,
Padua Univ. (Italy). Istituto di Elettrotecnica e di Elettronica; and Centro Veneto di Richerche Idrauliche, Padua (Italy).
For primary bibliographic entry see Field 07A.
W72-04848

SEASONAL METEOROLOGICAL CONDITIONS IN THE REGION OF THE BRATSK RESERVOIR (SEZONNYYE METEOROLOGICHESKIYE USLOVIYA V RAYONE BRATSKOGO VODOKHRANILISHCHA),
Limnologicheskii Institut, Irkutsk (USSR).
For primary bibliographic entry see Field 02H.
W72-04854

HYDROMETEOROLOGY IN PRECIPITATION MANAGEMENT,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 06B.
W72-04866

EVALUATION OF RADAR AND RAINGAGE SYSTEMS FOR FLOOD FORECASTING,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
W. M. Grayman, and P. S. Eagleson.
Available from the National Technical Information Service as COM-71-01102, $3.00 in paper copy, $0.95 in microfiche. Publication No. 138, (R71-21), August 1971. 427 p, 171 fig, 22 tab, 97 ref, 3 append. OWRR C-2137 (No 3403) (1).

Descriptors: *Raingages, *Simulated rainfall, *Radar, *River forecasting, *Flood damages, Watershed model, *Flood forecasting, *Forecasting, Evaluation, Networks, Measurement, Simulation analysis, River basins, Optimization, Rainfall-runoff relationships.
Identifiers: Kinematic wave method, Numerical methods.

The effects of the precipitation measuring system on the accuracy of real-time streamflow prediction are investigated through computer simulation. Included are a technical analysis of the errors introduced by radar and by raingages and an economic analysis of the precipitation measuring system when used in flood forecasting. A three-part computer simulation is used to represent the physical processes: (1) simulation of spatially distributed rainfall patterns, (2) representation of the precipitation measurement error, and (3) calculation of the streamflow hydrographs. Recommendations are made concerning the operation of radar. The relationship between a number of radar and raingage characteristics and the resulting error in hydrograph prediction is presented. A hypothetical river basin is simulated and the net benefits from a range of precipitation measuring systems used in flood warning are determined. The optimal configuration of the precipitation measuring system is determined for a range of economic development. On the basis of this example, it appears that the optimal system is a network of recording and telemetering raingages. The selection of a raingage-calibrated radar system must be justified through added benefits derived from other radar uses.
W72-04966

EQUILIBRIUM TEMPERATURES OF WATER SURFACES AS RELATED TO AIR TEMPERATURE AND SOLAR RADIATION,
Dartmouth Coll., Hanover, N.H. Dept. of Earth Sciences.
S. L. Dingman.
Water Resources Research, Vol 8, No 1, p 42-49, February 1972. 4 fig, 2 tab, 13 ref.

Descriptors: *Water temperature, *Air temperature, *Solar radiation, Heat transfer, Energy budget, Heat balance, Water quality, Reservoirs.

Equilibrium temperature Te is the water surface temperature at which net energy exchange to the atmosphere is zero. Since heat loss rate is a function of (Tw - Te), where Tw is the actual water surface temperature, the concept of equilibrium temperature is useful in predicting water temperatures. By selecting a set of equations to describe the heat exchange processes at the surface, curves can be drawn of heat exchange rate (excluding shortwave radiation) versus (Tw - Ta), where Ta is air temperature. These curves can be approximated by linear functions. The slopes q and intercepts Qo of these curves are in turn linear functions of wind speed for a specified set of weather conditions (clear and low humidity or cloudy and

high humidity). Using wind speed, air temperature, and net incoming solar radiation Qr, q and Qo can be calculated. Equilibrium temperature Te = ((Qr - Qo)/q) + Ta. This relation provides a simple yet general means of calculating Te and can be used to investigate time variations of Tw in response to meteorologic conditions. (Knapp-USGS)
W72-05026

SOME RESULTS OF HYDROMTEOROLOGICAL RESEARCH WORK CARRIED OUT IN THE EXPERIMENTAL BASINS OF THE METEOROLOGICAL SERVICE OF GERMAN DEMOCRATIC REPUBLIC,
Meteorologischer Dienst der Deutschen Demokratischen Republik, Berlin. Forschungsinstitut fuer Hydrometeorologie.
For primary bibliographic entry see Field 02A.
W72-05046

THE USE OF NON-DIMENSIONAL ONE--PARAMETER FUNCTIONS FOR THE DETERMINATION OF REGIONAL RAINFALL DEPTH--DURATION-FREQUENCY RELATIONS,
Water Planning for Israel Ltd, Tel Aviv (Israel).
For primary bibliographic entry see Field 02A.
W72-05047

A TRUNCATED SQUARE-ROOT-NORMAL DISTRIBUTION APPLIED TO MONTHLY PRECIPITATION TOTALS FOR GHENT (BELGIUM),
Ghent Rijksuniversiteit (Belgium). Astronomical Observatory and Seminar of the Theory of Probabilities and Mathematical Statistics.
P. Dingens, and H. Steyaert.
International Association of Scientific Hydrology Bulletin, Vol 16, No 2, p 79-85, June 1971. 4 fig, 2 tab.

Descriptors: *Statistics, *Rainfall, *Precipitation (Atmospheric), *Distribution patterns, Time series analyses, Data collections.
Identifiers: Belgium.

In a great number of cases the cube root of precipitation-data can be considered as being normally distributed. This has been tested for different lengths of periods and for diverse types of climate. Although a cube-root normal distribution seems to fit most of the data, in some cases some other root could lead to a better fit. A cube-root-normal distribution fits Canadian monthly rainfall totals. The distribution of monthly rainfall totals for Ghent (Belgium) is best fit not by the cube root, but the square root. (Knapp-USGS)
W72-05048

PRECIPITATION DATA AND ANALYSIS--VOLUME I, VENEZUELAN INTERNATIONAL METEOROLOGICAL AND HYDROLOGICAL EXPERIMENT (VIMHEX) HYDROLOGY REPORT,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W72-05095

CARBON DIOXIDE EXCHANGE OF A TROPICAL RAIN FOREST: PART I,
Connecticut Agricultural Experiment Station, New Haven.
G. R. Stephens, and P. E. Waggoner.
Bioscience. 20 (19): 1050-1053. 1970.
Identifiers: Carbon, Costa-Rica, Exchange, Forest, Oxide, Photosynthesis, Rain, Rates, Respiration, Tropical.

Photosynthesis, respiration, and leaf area were measured in a 50-yr-old premontane wet forest in Costa Rica. The estimated ratio of leaf to land area was nearly 3. Rates of photosynthesis of excised leaves of canopy and understory species were modest and respiration of understory plants was slow. Photosynthesis and respiration rates observed were compared to those of other tropical and temperature zone plants. (See also W72-05168)--Copyright 1971, Biological Abstracts, Inc.
W72-05167

CARBON DIOXIDE EXCHANGE OF A TROPICAL RAIN FOREST: PART II,
Cornell Univ., Ithaca, N.Y.
E. Lemon, L. H. Allen, Jr., and L. Muller.
Bioscience. 20 (19): 1054-1059. 1970. Illus.
Identifiers: Carbon, Exchange, Forest, Meteorological, Micro, Oxide, Rain, Techniques, Tropical.

The diurnal exchange of CO2 from a tropical rain forest is evaluated to gain insight into plant production processes in the tropics. Important geophysical information is provided that has bearing on the quality of the atmosphere. Micrometeorological techniques are used that do not disturb the environment but take advantage of the natural exchange processes. (See also W72-05167)--Copyright 1971, Biological Abstracts, Inc.
W72-05168

SPECIAL METEOROLOGICAL DATA NEEDS FOR AGRICULTURE,
Iowa State Univ., Ames. Dept. of Agronomy.
R. H. Shaw.
Iowa State J Sci. 45 (4): 529-539. 1971. Illus. Map.
Identifiers: Agriculture, Meteorological.

To define the special meteorological needs for agriculture, it is first necessary to obtain some concept of user requirements. In terms of these requirements, the station network density and observations to be made can be determined. Each meteorological parameter required is then briefly discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-05183

2C. Snow, Ice, and Frost

SNOWFALL FROM LAKE-EFFECT STORMS,
State Univ., Albany, New York.
For primary bibliographic entry see Field 02B.
W72-04845

SOME RESULTS OF HYDROMTEOROLOGICAL RESEARCH WORK CARRIED OUT IN THE EXPERIMENTAL BASINS OF THE METEOROLOGICAL SERVICE OF GERMAN DEMOCRATIC REPUBLIC,
Meteorologischer Dienst der Deutschen Demokratischen Republik, Berlin. Forschungsinstitut fuer Hydrometeorologie.
For primary bibliographic entry see Field 02A.
W72-05046

CHANGES IN SNOWMELT RUNOFF AFTER FOREST CLEARING ON A NEW ENGLAND WATERSHED,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 04A.
W72-05078

SPRING AND EARLY SUMMER TEMPERATURES IN A SHALLOW ARCTIC POND,
Department of Agriculture, Ottawa (Ontario). Entomology Research Inst.
H. V. Danks.
Arctic. 24 (2): 113-123. 1971.
Identifiers: Arctic, Bottom, Chironomids, Fauna, Pond, Shallow, Spring, Summer, Temperatures.

Temperatures were recorded continuously during spring and early summer in a shallow pond on Bathurst Island in the High Arctic; thawing was rapid. After the thaw seasonal and diel differences within the water and mud showed that frozen substrate had a marked effect on mud temperature, but that the superficial mud received almost as much heat as the water immediately above it. Temperature summations suggested that even in favorable shallow habitats low mud temperatures dictate the life-cycles of more than 1 yr of arctic chironomids. The maximum-minimum temperature midpoint was a satisfactory substitute for a recorded-obtained day-mean, and seasonal comparisons of pond temperatures in relation to bottom fauna could therefore be based on daily maximum and minimum mud surface temperatures.--Copyright 1971, Biological Abstracts, Inc.
W72-05163

SOME CRUSTACEAN ZOOPLANKTON OF THE NOATAK RIVER AREA, NORTHERN ALASKA,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 02H.
W72-05166

AN INVESTIGATION ON SLOPE EROSION BY MELTWATER OF SNOW-PATCHES IN MT. GASSAN, (IN JAPANESE),
Shinshu Univ., Matsumoto (Japan). Dept. of Geography.
For primary bibliographic entry see Field 02J.
W72-05218

2D. Evaporation and Transpiration

ENERGY BUDGETS OF FOUR PONDS IN NORTHWESTERN FLORIDA,
Bureau of Commercial Fisheries, Gulf Breeze, Fla. Estuarine Pesticide Lab.
Gerald E. Walsh.
Ecology. 52 (2): 298-304. 1971. Illus.
Identifiers: Budgets, Energy, Evaporation, Florida, Northwestern, Ponds, Radiation.

The annual energy budgets of 4 small ponds in northwestern Florida were calculated from the amounts of solar radiation, atmospheric long-wave radiation, black radiation, evaporative energy, conducted energy, and sensible heat which entered or was lost from the water. Long-wave radiation constituted between 62.1 and 63.9% of the total incoming 14.6 and 18.3% of the total. Between 370,498 and 631,970 kcal m-2yr-1 (37,050-/63,197 cal cm-2yr-1) were stored. Atmospheric radiation counteracts a portion of the radiative loss from water, thus reducing loss of stored solar energy.--Copyright 1971, Biological Abstracts, Inc.
W72-04907

THE STUDY OF EVAPORATION FROM SMALL SURFACES BY THE DIRECT MEASUREMENT OF WATER VAPOR PRESSURE GRADIENTS,
Toronto Univ. (Ontario). Dept. of Zoology.
John Machin.
J Exp Biol. 53 (3): 753-762. 1970.
Identifiers: Animals, Dew, Direct, Evaporation, Gradients, Measurement, Plants, Point, Pressure, Probe, Small, Surfaces, Vapor.

The construction, maintenance and calibration of a sensitive instrument capable of making numerous vapor pressure measurements within humidity gradients by the dew point method is described. Coefficients of diffusion of water vapor in air, calculated from observed vapor pressure gradients and measured rates of evaporation agree with theoretical and other experimental values in still air. Apparent coefficients in wind speeds between 10 and 100 cm/sec were significantly lower than those in still air. This finding, together with the performance of the dew point probe is discussed in relation to its possible use in the study of evaporation from animals and plants.--Copyright 1971, Biological Abstracts, Inc.

W72-04925

ECOLOGICAL CONDITIONS CAUSED BY EVAPORATION IN THE PONDS OF CAMARGUE,
Centre d'Oceanographie, Marseille (France).
P. Kerambrun, and K. H. Szekielda.
Hydrobiologia. 37 (2): 273-283. 1971. Illus. English summary.
Identifiers: Camargue, Ecological, Evaporation, France, Ponds, Salinity, Temperature, Wind.

During the highest evaporation period, investigations showed a high seasonal increase in salinity and temperature in the ponds of the Camargue. This is characteristic for each pond. It was concluded from chromatographic studies that the salt composition in the water differs from that of the neighboring sediment. This difference depends on the evaporation process. An important horizontal gradient in salinity is observed in the first meters nearest to the shore. These gradients are variable and may be controlled by the winds.--Copyright 1971, Biological Abstracts, Inc.
W72-05007

FOREST TRANSPIRATION REDUCTION BY CLEARCUTTING AND CHEMICAL TREATMENT,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.

Proceedings of the Northeastern Weed Control Conference, Vol 23, p 344-349, January 1969. 1 fig, 1 tab, 5 ref.

Descriptors: *Clear-cutting, *Ecosystem, *Herbicide, *Streamflow, *Precipitation, *Snowmelt, *Water yield improvement, *Hydrologic equations, Water chemistry, Water analysis, 2-4-5-T, New Hampshire.
Identifiers: *Reducing evapotranspiration, *Transpiration, *Bromacil, *Sprout growth from stumps, *Low-flow augmentation, Hubbard Brook Experimental Forest (NH).

This paper concerns a study to determine the magnitude of water that could be gained in streamflow by eliminating transpiration in a forested watershed in the White Mountains of New Hampshire. The forest of a watershed was clearcut, no forest products were removed, and herbicides were applied to prohibit revegetation. Water yields during the growing seasons of 1966 and 1967 were increased at least twofold above the untreated watersheds. Quantitative water gains were 320,000 and 226,000 gallons per acre, respectively for the 2 years. This experiment supports other data indicating that low-flow augmentation is possible by manipulating vegetation. (Reeves-Forest Service)
W72-05077

SPATIAL VARIATION OF NET RADIATION, ALBEDO AND SURFACE TEMPERATURE OF FORESTS,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
C. A. Federer.
Journal of Applied Meteorology, Vol 7, No 5, p 789-795, October 1968. 8 fig, 2 tab, 12 ref.

Descriptors: *Radiation, *Energy equations, *Energy transfer, *Solar radiation, *Meteorology, *Air temperature, *Heat transfer, New Hampshire.
Identifiers: *Economical radiometers, *Spatial variation, *Albedo, *Net radiation, *Radiation sensor, Energy balance.

The objective was to evaluate spatial variation of net radiation above a uniform hardwood forest canopy and associated cover types and to provide information on spatial sampling required to obtain the mean net radiation. Economical radiometers were placed at 12 locations within an area of about 1 hectare. Measurements were made about every half-hour on selected clear days in summer, autumn, and winter. Time-averaged hardwood albedos generally had a range of 0.03, while the albedos of all locations had a range of about 0.13, except in winter. Hardwood surface temperatures had a range varying from 1-5C, while all sites ranged from 5-11C. These spatial variations in surface temperature and albedo were about equally important in affecting net radiation. The range of net radiation among hardwood locations was 0.03 ly /min-1, while over all sites it was within 0.11 ly /min-1, except in winter.
W72-05079

ECONOMICAL RADIOMETER THEORY, PERFORMANCE AND CONSTRUCTION,
Wisconsin Univ., Madison. Coll. of Agricultural and Life Sciences.
C. B. Tanner, C. A. Federer, T. A. Black, and J. B. Swan.
Research Report 40, January 1969. 86 p, 25 fig, 10 tab, 22 ref.

Descriptors: *Radiation, *Solar radiation, *Meteorology, *Energy transfer, *Wavelengths, *Energy equations.
Identifiers: *Economical radiometer, *Hemispherical radiation, *Energy balance, *Solar radiation equations, *Net radiation, *Theory, Weather resistant radiometer, Mounting heads and stands, Radiometer constants.

The economical radiometer has four completely separate radiation receivers; 'black' and 'white' surfaces face both up and down, so that all the radiation fluxes can be determined separately. The radiometer is rugged, lighweight, and simple to construct. The advantages of this instrument are: (1) small heat conduction losses to the air; (2)incoming and outgoing fluxes of total, solar, and thermal radiation can be determined; (3) it can be fabricated simply and in large numbers without special tools; (4) individual calibration is not required for most agriculture meteorological work; (5) the instrument is excellent for measuring nocturnal radiation; and (6) it is useful in measuring the difference in net radiation over adjacent, dissimilar, agricultural surfaces. It is subject to several disadvantages: (1) solar altitude must be measured and included in computations when beam radiation is dominant; (2) the theory is developed only for beam radiation under clear conditions or diffuse radiation under overcast conditions; (3) there is a time-lag between the measured and actual radiation; (4) the instrument must be protected at night against condensation on the ventilation shields and requires frequent changes of ventilation shields in dirty atmospheres, and (5) the size is rather large. (Reeves-Forest Service)
W72-05081

NUMERICAL MODELING OF UNSATURATED GROUNDWATER FLOW INCLUDING EFFECTS OF EVAPOTRANSPIRATION,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 02G.
W72-05089

LEGAL ASPECTS OF WATER SALVAGE,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 06E.
W72-05098

IN SITU MEASUREMENT OF SOIL AND PLANT LEAF WATER POTENTIAL,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
S. L. Rawlins, W. R. Gardner, and F. N. Dalton.
Soil Science Society of America Proceedings, Vol 32, No 4, p 468-470, July-August 1968. 2 fig, 6 ref.

Descriptors: *Transpiration, *Tensiometers, *Soil water, Soil moisture, Hygrometry, Soil-water-plant relationship.
Identifiers: *Soil water potential.

For a pepper plant (Capsicum frutescens L.) growing in a greenhouse, soil water potential was measured with tensiometers and a thermocouple psychrometer, plant water potential was inferred from a calibrated beta gauge, and transpiration was measured by weighing the soil-plant system. Water moved through the transpiration stream in the direction of the gradient of the water potential. Regardless of the distribution of water in the soil, transpiration was unaffected by soil water content until it dropped to a value corresponding to -6 to -8 bars water potential. Below this water content, transpiration decreased linearly with soil water content, transpiration decreased linearly with soil water content to a soil water potential of -37 bars. At this time the plant water potential was below -50 bars and the transpiration rate was near zero. After irrigation the plant regained full turgor. (Skogerboe-Colorado State)
W72-05136

A PHYSICAL ANALYSIS OF DIURNAL TEMPERATURE REGIMES IN CLEAR AND TURBID WATER LAYERS: A PROBLEM IN RICE CULTURE,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
C. W. Rose, and A. L. Chapman.
Agricultural Meteorology, Vol 5, p 391-409, 1968. 9 fig, 2 tab, 18 ref.

Descriptors: *Rice, *Turbidity, *Water temperature, *Solar radiation, Radiation, Diurnal distribution, Irrigation, Evaporation control.
Identifiers: Thermal transport, Australia.

Water temperature is an important factor in the establishment of a rice crop by broadcasting pregerminated seed into flooded fields. In the tropics water temperatures often exceed the optimum for this method of establishment. At Coastal Plains Research Station 12 deg. 33 min. S 131 deg. 20 min. E) near Darwin, N.T., Australia, a rice field environment was simulated using tanks. Diurnal temperature profiles were measured in 10- and 30-cm layers of clear water with and without an evaporation suppressant, and turbid water, for the months of December and June. The patterns of temperature in clear and turbid water were consistently different at both times of year. Marked temperature gradients (up to 1 deg. C/cm) occurred by day in turbid water, with maxima at the air-water interface, but gradients in clear water were invariably very small. The physical theory of radiation absorption and thermal transport in a water layer is presented and used to interpret the observations of temperature. A crucial factor in the interpretation relates to the conditions which govern the onset of convective motion. The analysis indicates that the temperature in clear water layers will be uniform throughout at all times and for all depths used in rice culture. The same will be true in turbid water at night, but during the day temperature will decrease with depth. (Skogerboe-Colorado State)
W72-05144

PLANT GROWTH-EVAPOTRANSPIRATION RELATIONS FOR SEVERAL CROPS IN THE CENTRAL GREAT PLAINS,
Utah State Univ., Logan.
R. J. Hanks, H. R. Gardner, and R. L. Florian.
Agronomy Journal, Vol 61, No 1, p 30-34, January-February, 1969. 5 fig, 1 tab, 9 ref.

Descriptors: *Evapotranspiration, *Evaporation, *Lysimeters, *Transpiration, Wheat, Oats, Water conservation, Water utilization, Dry farming, Great Plains, Sorghum.
Identifiers: Millet.

Lysimeters, which eliminated runoff and percolation below 90 cm, caused about 10 cm of additional water to be available for growth of grain sorghum in 1967. This additional water doubled yields, with an increase in evapotranspiration of only 50%. Evaporation from soil in the lysimeter was only 32% of the evapotranspiration, compared with

50% for the soil surrounding the lysimeter. Evaporation from the soil within a winter wheat crop during the actively growing period in the spring, was estimated to be 15 and 37% of evapotranspiration for 1966 and 1967 respectively. Evaporation from the soil within the actively growing crop was estimated to be 34 and 20% of the evapotranspiration for oats and millet, respectively. Estimates of the amount of water evaporated from the soil within a crop allowed for estimation of transpiration from measurements of evapotranspiration. These data indicate that production and transpiration are directly related in this dryland area as previously suggested. (Skogerboe-Colorado State)
W72-05147

CONCEPTS OF SOIL MOISTURE AVAILABILITY AND THEIR EFFECT ON SOIL MOISTURE ESTIMATES FROM A METEOROLOGICAL BUDGET,
Department of Agriculture, Ottawa (Ontario). Plant Research Inst.
W. Baier.
Agricultural Meteorology, Vol 6, p 165-178, 1969. 3 tab, 5 fig, 13 ref.

Descriptors: *Soil moisture, *Evapotranspiration, *Moisture availability, *Meteorology, Meterological data, Evaporation, Transpiration.
Identifiers: *Versatile budget.

Soil moisture measurements by means of Colman electrical resistance blocks over 10 years were used to test the effect of various relationships between plant-available soil moisture (SM) and the ratio of actual (AE) to potential (PE) evapotranspiration on soil moisture estimates obtained by the versatile budget. Depending on the type of relationship used, correlation coefficients (ranging from 0.76 to 0.85) between 5-day means of SM observations and estimates differed significantly and mean errors varied from 3 to 39% of the observed seasonal means. Under the local experimental conditions, a linear relationship between SM and AE/PE gave estimates most closely related to the observations. The results suggest that when a realistic SM vs. AE/PE relationship is used in the versatile budget, a precision of the estimates comparable to the error involved in measuring soil moisture in the field by conventional methods can be achieved. (Skogerboe-Colorado State)
W72-05149

ADVECTION AND EVAPOTRANSPIRATION OF WIDE-ROW SORGHUM IN THE CENTRAL GREAT PLAINS,
Utah State Univ., Logan. Dept. of Soils and Meteorology.
R. J. Hanks, L. H. Allen, and H. R. Gardner.
Agron J. 63 (4): 520-527. 1971.
Identifiers: Advection, Central, Climate, Edge, Evapo, Great, Irrigation, Micro, Plains, Row, Soil, Sorghum-M, Temperature, Transpiration.

This study was conducted to evaluate the importance of advection as a source of energy for evapotranspiration from grain sorghum planted in 1-m rows with both irrigated and dryland conditions. Detailed measurements of temperature, water vapor content, and wind speed were made within and above the canopy at various times and positions within the field during August 1967. Evapotranspiration was also measured by soil moisture sampling. Three types of advection were observed. Within canopy advection resulted from the large amount of exposed dry soil between rows, which caused soil temperature between the rows to be as much as 20 C higher than plant temperature. About 64% of the energy used to heat up the soil was used for transpiration in the irrigated plot, whereas only about 21% of the energy was used for transpiration in the dryland plot. Border advection, manifested by horizontal temperature and water vapor gradients, occurred over most of the plot irrigated but was most evident from 0 to 40 m from the upwind edge. This type of advection yielded sufficient energy to account for about 30% of the energy used for evapotranspiration from the irrigated plot. Large scale advection, manifested by temperature inversions, was found to occur during the night and probably yielded very little energy used for evapotranspiration.--Copyright 1971, Biological Abstracts, Inc.
W72-05186

LIMITS ON WESTERN RANGE FORAGE PRODUCTION: WATER OR MAN,
Agricultural Research Service, Logan, Utah. Plant Science Research Div.
For primary bibliographic entry see Field 04A.
W72-05230

EFFECT OF GROWTH REGULATOR AND ANTI-TRANSPIRANT CHEMICALS ON WATER REQUIREMENT AND GROWTH COMPONENTS OF ALFALFA (MEDICAGO SATIVA L.),
Agricultural Research Service, Beltsville, Md. Field Crops and Animal Products Research Branch.
For primary bibliographic entry see Field 03F.
W72-05232

EPICUTICULAR WAX IN THE STOMATAL ANTECHAMBER OF SITKA SPRUCE AND ITS EFFECTS ON THE DIFFUSION OF WATER VAPOUR AND CARBON DIOXIDE,
Aberdeen Univ. (Scotland). Dept. of Botany.
C. E. Jeffree, R. P. C. Johnson, and R. G. Jarvis.
Planta. 98 (1): 1-10. 1971. Illus.
Identifiers: Antechamber, Carbon, Cuticular, Diffusion, Oxide, Photosynthesis, Picea-Sitchensis-G, Sitka, Spruce-G, Stomatal, Transpiration, Vapor, Wax.

The distribution of wax tubes on (Picea sitchensis) leaf surfaces is described, especially the presence of wax tubes in the antechambers of the stomata. The extra resistances which the wax-filled antechambers add to the other resistances in the pathway for diffusion of water vapor and of carbon dioxide are calculated. It is concluded that the wax-filled stomatal antechambers reduce the rate of transpiration by about two thirds but reduce the rate of photosynthesis by only about one third. Thus wax-filled stomatal antechambers are excellent antitranspirants.--Copyright 1971, Biological Abstracts, Inc.
W72-05241

THE RESPONSE OF TRANSPIRATION RESISTANCE TO LEAF TEMPERATURE AS A DESICCATION RESISTANCE MECHANISM IN TREE SEEDLINGS,
Wisconsin Univ., Madison. Dept. of Forestry.
James E. Wuenscher, and Theodore T. Kozlowski.
Physiol Plant. 24 (2): 254-259. 1971. Illus.
Identifiers: Acer-Saccharum-D, Desiccation, Leaf, Mechanism, Quercus-D-Spp, Resistance, Seedlings, Temperature, Transpiration, Tree.

Transpiration rate and leaf transfer resistance to water vapor loss were determined under a range of leaf temperatures for Quercus macrocarpa, Q. velutina, Q. alba, Q. rubra, and Acer saccharum. Transfer resistance increased with rising leaf temperatures between 20 to 40 deg. C in all species, but the rate of increase in resistance was greatest in species which normally occupy xeric sites. Increased transfer resistance with rising leaf temperature may be significant in preventing rapid desiccation of leaves under the large evaporative stress imposed by high leaf temperature.--Copyright 1971, Biological Abstracts, Inc.
W72-05244

THE WATER OUTLAY BY EICHHORNIA CRASSIPES AND OBSERVATIONS ON THE PLANT CHEMICAL CONTROL,
Ain Shams Univ., Cairo (Egypt).
For primary bibliographic entry see Field 04A.
W72-05247

POSSIBILITY OF REDUCTION OF PLANT TRANSPIRATION DURING SUMMER TRANSPLANTATIONS BY MEANS OF ANTITRANSPIRANTS, (IN RUSSIAN),
V. F. Berzilov, and L. A. Khvatova.
Izv Akad Nauk SSSR Ser Biol. 4. 562-568. 1970. Illus. English summary.
Identifiers: Aqueous, Balance, Emulsion, Latex, Plant, Reduction, Seedlings, Summer, Transpirants, Transpiration, Transplantations, Tree, Water.

Sprinkling of plants with an aqueous latex emulsion leads to the formation on the leaves of transparent elastic films which are rather resistant to influences of the external environment. These films are retained on the leaf surfaces for 16-22 days. The preparation considerably reduces transpiration which helps maintain a more favorable water balance and successful growth of the transplanted tree seedlings.--Copyright 1971, Biological Abstracts, Inc.
W72-05253

2E. Streamflow and Runoff

DETECTION OF A CHANGE IN RUNOFF BY AN ANALYSIS OF DAILY FLOWS,
Department of Natural Resources, Quebec.
For primary bibliographic entry see Field 02A.
W-72 04846

A FLOOD-FREQUENCY RELATION BASED ON REGIONAL RECORD MAXIMA,
Geological Survey, Washington, D.C.
P. H. Carrigan, Jr.
Available from GPO, Sup Doc, Washington, D.C. 20402, 40 cents. Geological Survey Professional Paper 434-F, 1971. 22 p, 8 fig, 3 tab, 10 ref.

Descriptors: *Flood forecasting, *Statistical methods, *Frequency analysis, Computer models, Streamflow, Peak discharge, Regional flood, Input-output analysis, Hydrologic data.
Identifiers: Flood-recurrence intervals.

In flood-frequency analysis the regional variation of flood intensity is commonly related, using regression analysis, to variations in basin and climatic characteristics. This reduces the sample size to one sampling in time, and it is applicable to the entire region. Techniques of analysis are introduced to increase the sample size by taking account of the random variations of flood intensity in both time and space. As a result of increasing the sample size, the recurrence interval for the maximum event is increased; the increase may be as great as the number of years of record. The recurrence interval for the maximum annual flood in the region can be estimated by a computer-simulation model. By means of a principal-component transform, the matrix of correlation coefficients is used in connection with a normal random-number generator to generate synthetic sets of normally distributed flood intensities equal in number and duration to observed sets of records. The maximum event from each synthetic record is found, and the maxima are ranked in descending order. The exceedance probability (reciprocals of recurrence intervals) of the ordered maxima are repeatedly determined to estimate the average normal exceedance probability for each order. The estimate of probability is independent of the statistical distribution of the observed floods. The construction of a flood-frequency relation for any station can be accomplished by graphically relating the observed ordered maxima to the estimated recurrence interval. (Woodard-USGS)
W72-04797

FLOW OVER ROUNDED SPILLWAYS,
Liverpool Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.

W72-04809

FLOODS ON YAHARA RIVER, LAKE KEGONSA DAM TO COUNTY LINE, DANE COUNTY, WISCONSIN,
Geological Survey, Madison, Wis.
For primary bibliographic entry see Field 04A.
W72-04815

RESULTS OF A FIELD STUDY USING THE 3-AXIS DOPPLER SHIFT CURRENT METER,
John Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 02L.
W72-04817

THE CHESAPEAKE BAY INSTITUTE WAVE FOLLOWER--PART II,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 07B.
W72-04818

FLOODS OF JULY 4-8, 1969 IN NORTH-CENTRAL OHIO,
Geological Survey, Columbus, Ohio.
R. I. Mayo, E. E. Webber, and D. W. Ellis.
Geological Survey Open-file Report, November 1971. 38 p, 4 fig, 3 tab, 9 ref.

Descriptors: *Floods, *Flood damage, *Historic flood, *Peak discharge, *Ohio, Stream gages, Streamflow, Flow rates, Rainfall-runoff relationships, Reservoirs, Gaging stations, River basins, Sediment transport, Hydrologic data.
Identifiers: Ohio floods (North-Central).

The storm of July 4-5, 1969, in north-central Ohio caused unprecedented flooding. More than 14 inches of rain fell in less than 24 hours at several places. More than 4 inches of rainfall occurred on about 6,000 square miles. Of the 50 sites for which the peak discharge was determined, 40 are located on unregulated streams. The peak discharge at five of the sites was four times as large as the discharge of the 50-year flood, and the peak discharge for 17 sites was more than twice as large as that of the 50-year flood. Forty-one deaths and more than $66 million in property damage was attributed to the rainstorm, accompanying wind, and resulting floods. Peak stages and/or discharges are summarized for 55 sites (including five reservoirs) in the upper Muskingum River basin, lower Sandusky River basin, and in the Huron, Vermilion, and Black River basins. (Woodard-USGS)
W72-04852

PEAKING-STATION LAYOUTS ON HIMALAYAN RIVERS,
Kishau Dam Planning Div., Dehra Dun (India).
For primary bibliographic entry see Field 04A.
W72-04875

A MODULAR DISTRIBUTED MODEL OF CATCHMENT DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
B. M. Harley, F. E. Perkins, and P. S. Eagleson.
Available from the National Technical Information Service as PB-206 955, $6.00 in paper copy, $0.95 in microfiche. Technical Report No. 133 (R70-80), Dec. 1970. 537 p, 132 fig, 15 tab, 43 ref, 2 append. OWRR C-1706 (No. 3158) (1).

Descriptors: *Runoff, *Streamflow, Surface waters, *Flood routing, *Hydrologic models, Urban storm runoff, Mathematical models, Frequency analysis, *River basins, *Model studies, Simulation analysis, *Routing, Flow, *Watersheds (Basins).
Identifiers: Kinematic wave method, Method of characteristics, John Hopkins Storm Drainage Project, Routing models, *Linear flood routing, Distributed models, Catchment models.

The development of a general purpose river basin distributed simulation model is described. The problems of network decomposition and lumped-parameter element recognition are discussed, and a scheme suitable for any specific tree-like network proposed. Two methods of flood routing within the individual elements have been implemented in the currently operational model, these being the simple non-linear kinematic wave model and a complex linear solution to the full equation of motion. The properties and behavior of these routing models under various conditions are examined, and recommendations regarding their suitability in various flow regimes set forth. Results obtained using these routing techniques are compared to both experimental and field data and to those obtained using a numerical solution of the full non-linear equations. A problem-oriented language suitable for river basin simulation studies has been developed and implemented on a time sharing system.
W72-04896

EVALUATION OF RADAR AND RAINGAGE SYSTEMS FOR FLOOD FORECASTING,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 02B.
W72-04966

THE ANNUAL TEMPERATURE REGIME OF A SMALL STREAM IN NEW ZEALAND,
Marine Dept., Wellington (New Zealand). Fisheries Research Div.
C. L. Hopkins.
Hydrobiologia. 37 (3/4): 397-408. 1971. Illus. Maps. French summary.
Identifiers: Annual, Benthic, Invertebrates, New Zealand, Regime, Stream, Temperature, Trichoptera.

An electrically operated strip-chart recorder was installed in the Hinau Stream, a small hill stream in the North Island of New Zealand. With this instrument the temperatures of the stream, air, and a small spring were monitored for 2 yr. Mercury-in-glass maximum/minimum thermometers were installed at 2 other points in the stream system, one 500 m below the site sampled by the recorder probes and the other in another stream which joined the first. The annual temperature in the stream at the site of the continuous recorder ranged from 6 DEG. C to 18.5 deg. C. Annual range in the spring water was much less, 10-14 deg. C. The greatest daily range in temperature in both air and water was found during summer and the smallest in winter. Data taken 500 m down stream of the continuously recorded site showed that summer maxima were 3-4 degrees higher than in the upper reaches, though the minima were about the same at the 2 sites. During winter there was little difference between the 2 sites. Data from certain other waters with wider annual temperature ranges showed summer maxima to be higher than in the Hinau, but winter minima to be about the same. Maximum temperature in the Hutt River where it flowed through thickly forested country was much less than in the same river in cleared land down stream and also much less than in 2 other rivers in open country for which data exist. Comparison of quantitative samples of benthic invertebrates taken from different parts of the Hinau Stream showed that several species of Trichoptera were more abundant in the recorder-monitored headwater than elsewhere in the stream. This may have been partly due to the less extreme temperature conditions in the headwater.--Copyright 1971, Biological Abstracts, Inc.
W72-04987

ON THE GENERATION OF LONG WAVES,
Army Coastal Engineering Research Center, Washington, D.C.
O. S. Madsen.
Journal of Geophysical Research, Vol 76, No 36, p 8672-8683, December 20, 1971. 7 fig, 19 ref.

Descriptors: *Ocean waves, *Oceanography, *Ocean circulation, *Model studies, *Waves (Water), Height, Forecasting, Coasts, Beaches.
Identifiers: *Wave maker, Long waves (Oceans).

For relatively long waves generated by a piston-type wave maker, the classical linear wave-maker theory is extended to second order accuracy. Within the limits of validity of the theory, this agrees well with experimental results for the motion generated by a sinusoidally moving wave maker, and shows that secondary waves are associated with the existence of a second harmonic free wave. By giving the wave maker, a motion that consists of a first and a second harmonic, it is shown that this free second harmonic wave may be eliminated, so that the generated wave is virtually of permanent form. (Woodard-USGS)
W72-05039

WATER RESOURCES DATA FOR WISCONSIN, 1969: PART L. SURFACE WATER RECORDS, AND PART 2. WATER QUALITY RECORDS.
Geological Survey, Madison, Wis. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-05094

STREAMFLOW, GROUNDWATER AND GROUND RESPONSE DATA--VOLUME II, VENEZUELAN INTERNATIONAL METEOROLOGICAL AND HYDROLOGICAL EXPERIMENT (VIMHEX) HYDROLOGY REPORT,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W72-05096

A COMPARISON OF NITROGEN LOSSES FROM UREA AND AMMONIUM NITRATE IN SURFACE RUNOFF WATER,
Purdue Univ., Lafayette, Ind. Agricultural Experiment Station.
For primary bibliographic entry see Field 05B.
W72-05142

2F. Groundwater

RECORDS OF WELLS, DRILLERS' LOGS, AND CHEMICAL ANALYSIS OF GROUND WATER IN GALVESTON COUNTY, TEXAS 1952-1970,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 04B.
W72-04795

RELATION OF PONDED FLOODWATER FROM HURRICANE BEULAH TO GROUND WATER IN KLEBERG, KENEDY, AND WILLACY COUNTIES, TEXAS,
Geological Survey, Austin, Tex.
E. T. Baker, Jr.
Texas Water Development Board Report 138, Austin, December 1971. 30 p, 16 fig, 3 tab, 7 ref.

Descriptors: *Groundwater movement, *Floodwater, *Surface-groundwater relationships, *Ponding, *Texas, Infiltration, Hydrogeology, Water level fluctuations, Seepage, Geology, Topography, Hydrologic data, Water quality, Water analysis, Chemical analysis, Water wells, Water table, Aquifers, Surface-groundwater relationships.
Identifiers: *Hurricane Beulah, *South Texas.

Torrential rainfall from Hurricane Beulah caused floods of record-breaking magnitude in south Texas in September and October 1967. A 3,000-square-mile area, having no defined drainage system, was largely inundated by ponded floodwater which collected in hundreds of shallow depressions. The relation of the ponded floodwater to the groundwater was studied at three sites -King Ranch site in Kleberg County, Armstrong

Ranch site in Kenedy County, and La Sal Vieja site in Willacy County. The amount of recharge or seepage outflow, in terms of unit area of water surface, was 0.8 foot during a 9.5 month period at the Armstrong Ranch site and 3.5 feet during a 12-month period at the King Ranch site. Volume of recharge at the King Ranch site was about 120 acre-feet. The ponded water was more saline at the Armstrong Ranch and La Sal Vieja sites, where groundwater discharge occurred by seepage inflow to the ponds, than at the King Ranch site where groundwater discharge was absent. Two years after Hurricane Beulah, the hydrologic system was steadily approaching pre-Beulah conditions. (Woodard-USGS)
W72-04796

SALTY GROUND WATER AND METEORIC FLUSHING OF CONTAMINATED AQUIFERS IN WEST VIRGINIA,
Environmental Protection Agency, Wheeling, W. Va.
For primary bibliographic entry see Field 05B.
W72-04801

THE USE, ABUSE AND RECOVERY OF A GLACIAL AQUIFER,
Williams and Works, Grand Rapids, Mich.
For primary bibliographic entry see Field 05B.
W72-04802

METHODS OF GEOLOGIC EVALUATION OF POLLUTION POTENTIAL AT MOUNTAIN HOMESITES,
Colorado State Univ., Fort Collins. Dept. of Geology.
For primary bibliographic entry see Field 05B.
W72-04803

FINITE DIFFERENCE SOLUTIONS OF AXISYMMETRIC INFILTRATION THROUGH PARTIALLY SATURATED POROUS MEDIA,
Utah State Univ., Logan. Coll. of Engineering.
For primary bibliographic entry see Field 02G.
W72-04805

INVERSE SOLUTIONS TO THREE-DIMENSIONAL FREE SURFACE POTENTIAL FLOWS,
Utah State Univ., Logan. Coll. of Engineering.
R. W. Jeppson.
Utah Water Research Laboratory Report PRWG-83-1, May 1971. 56 p, 61 fig, 4 tab, 21 ref, 3 append. NSF Grant GK-14707.

Descriptors: *Groundwater movement, *Porous media, *Free surfaces, *Flow nets, *Numerical analysis, Analytical techniques, Boundaries (Surfaces), Flow rates, Seepage, Dams, Computer programs, Systems analysis, Input-output analysis, Darcys law.

Methods are developed and defined for obtaining numerical solutions to three-dimensional, free surface, inviscid, incompressible fluid flows and three-dimensional free surface Darcian flow in porous media. The methods are based on a formulation in a space defined by a potential function and two mutually orthogonal stream surfaces whose intersections define the streamlines of the flow. In this space the positions of free surfaces are known. The formulation considers the magnitudes of the cartesian coordinates x, y, and z as the dependent variables. The applicability of the methods are demonstrated by implementing them in a computer program and by obtaining solutions to four problems with slightly different geometries of three-dimensional Darcian seepage flow of water through a dam with a drain over only a portion of the toe. Isometric drawings of the space flownets display the results. Also a number of regular flownets are given which were constructed by projecting the points of intersection of the two stream surfaces and/or equipotential surfaces onto horizontal or vertical planes. (Woodard-USGS)
W72-04808

GROUND-WATER LEVELS IN IDAHO, 1971.
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 04B.
W72-04819

GROUND-WATER PUMPAGE FROM THE SNAKE PLAIN AQUIFER, SOUTHEASTERN IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 04B.
W72-04820

ESTIMATED SUBSIDENCE IN THE RAYMOND BASIN, LOS ANGELES COUNTY, CALIFORNIA, FOR A POSTULATED WATER-LEVEL LOWERING, 1970-2020,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 04B.
W72-04823

HYDROGEOLOGY AND HYDRODYNAMICS OF GROUNDWATER (GIDROGEOLOGIYA I GIDRODINAMIKA PODZEMNYKH VOD),
Vsesoyuznyi Neftegazovyi Nauchno-Issledovatelskii Institut, Moscow (USSR).

Izdatel'stvo 'Nedra', Moscow, 1971. 184 p.

Descriptors: *Hydrogeology, *Hydrodynamics, *Groundwater, Confined water, Natural resources, Natural gas, Oil-water interfaces, Brines, Water chemistry, Water properties, Flow, Pressure, Temperature, Water wells, Boreholes, Aquifers, Geophysics, Exploration, Drilling, Instrumentation.
Identifiers: *USSR, *Artesian basins, Gas-water interfaces, Mineralization.

This monograph consisting of 12 chapters is divided into three sections: I--principles of general hydrogeology; II--groundwater dynamics; and III--hydrogeology of oil and gas deposits. Special attention is given in Section I to chemical composition and physical properties of groundwater, its origin and industrial importance. Basic principles of groundwater hydraulics reviewed in Section II are examined from the standpoint of natural movement of waters and brines in artesian basins and of fluid flow toward boreholes and wells. The concluding section is devoted to study of the use of hydrogeological data in exploration and mining of oil and gas deposits and to methods for investigation of water wells. A brief description is given of hydrogeological conditions of the major oil- and gas-bearing regions of the USSR, including the Volga-Ural, West Siberian, Dnieper-Donetsk, Western and Eastern Ciscaucasian, Terek-Dagestan, Southern Mangyshlak, West Turkmen and Azerbaydzhan artesian basins. The text has been approved by the Ministry of Higher and Secondary Specialized Education of the USSR for use in technical schools engaged in petroleum and geological research. (Josefson-USGS)
W72-04832

PROGRESS REPORT ON THE ANALOG MODEL STUDY OF THE MAGOTHY AQUIFER IN THE ANNAPOLIS, MARYLAND AREA.
Geological Survey, Parkville, Md. Water Resources Div.
For primary bibliographic entry see Field 04B.
W72-04840

QANAT SYSTEMS IN IRAN,
For primary bibliographic entry see Field 04B.
W72-04849

RESISTIVITY SOUNDINGS IN THE CONDROZ (BELGIUM) WITH SCHLUMBERGER AND DIPOLE ARRAYS; APPLICATION TO LIMESTONE AQUIFER EVALUATION,
Ghent Rijksuniversiteit (Belgium). Geologisch Instituut.
J. P. Henriet.
International Association of Scientific Hydrology Bulletin, Vol 16, No 1, p 25-37, March 1971. 7 fig, 21 ref.

Descriptors: *Electrical studies, *Limestones, *Aquifer characteristics, *Hydrogeology, Conductivity, Geophysics, Sounding, Surveys, Subsurface investigations, Karst, Groundwater basins.
Identifiers: Condroz (Belgium).

Four geoelectrical soundings were measured with a combination of Schlumberger and azimuthal or equatorial dipole electrode arrays on a Carboniferous limestone basin of the Condroz area, Belgium. The measuring technique is briefly outlined as well as the interpretation procedure, which follows a closed-loop scheme with control of calculated model curves. Some general problems of interpretation of geoelectrical sounding curves are discussed, as far as they have a practical bearing on the treatment of Condroz. The problem of determining the very high resistivity of limestone is approached through ARCHIE's formula, an empirical relation between the bulk rock resistivity, the porosity and the electrolyte resistivity. An evaluation of porosity and resistivity, combined with electrical horizontal conductance measurements directly made on resistivity sounding curves, offers a possibility for fast determination of the total water storage in a limestone aquifer. Such storage determinations could be applied whenever an aquifer shows up as a conductive layer interbedded between two highly resistant layers. (Knapp-USGS)
W72-04850

GROUNDWATER DISCHARGE: A COMMON GENERATOR OF DIVERSE GEOLOGIC AND MORPHOLOGIC PHENOMENA,
Research Council of Alberta, Edmonton.
J. Toth.
International Association of Scientific Hydrology Bulletin, Vol 16, No 1, p 7-24, March 1971. 19 fig, 25 ref.

Descriptors: *Discharge (Water), *Springs, *Geysers, *Swamps, *Surface-groundwater relationships, Saline water systems, Permafrost, Geomorphology, Land forming, Groundwater movement, Hydrogeology.

Four natural conditions coexist with hydraulic discharge of groundwater: positive gradient of the fluid potential, low relative topographic position, allochthonous water quality, and allochthonous water temperature. These conditions are consistently associated with springs, seepages, quicksand, soap holes, geysers, frost mounds, pingos, groundwater lakes, and marshes, near-surface accumulations of salts, landslides, slumps, soil creep, and gullying. These features have one common generator: groundwater discharge. These geomorphic and geologic phenomena are interpreted as environmentally modified expressions of the hydraulic discharge of groundwater through topographically controlled gravity flow systems. (Knapp-USGS)
W72-04851

THE EFFECTS OF ELECTROKINETICS UPON INCRUSTATION IN WATER WELLS,
Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 08A.
W72-04870

HYDROLOGIC DATA FOR THE SAN LUIS VALLEY, COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07C.
W72-05025

APPLICATION OF GALERKIN'S PROCEDURE TO AQUIFER ANALYSIS,
Geological Survey, Washington, D.C.
G. F. Pinder, and E. O. Frind.
Water Resources Research, Vol 8, No 1, p 108-120, February 1972. 10 fig, 2 tab, 21 ref.

Descriptors: *Groundwater movement, *Numerical analysis, Mathematical studies, Equations, Aquifer characteristics, Hydraulic conductivity, Transmissivity, Water yield, Drawdown, Mathematical models.
Identifiers: Finite difference method, *Galerkin procedure.

Groundwater flow equations may be solved using the Galerkin procedure to generate the approximating equations. The integrals in the resulting equations may be efficiently evaluated by using isoparametric quadrilateral elements and numerical integration. A comparison of solutions for an idealized problem obtained by using Galerkin techniques and finite difference techniques indicates they achieve approximately the same degree of accuracy. A field application of the two methods shows that the Galerkin procedure provides satisfactory solutions with far fewer nodes than were required for the finite difference approach. In selecting a method for a particular hydrologic problem the flexibility of the irregular subspaces used in the Galerkin approach must be weighed against the very efficient equation-solving schemes applicable to the finite difference equations. (Knapp-USGS)
W72-05032

GROUNDWATER FLOW IN A SANDY TIDAL BEACH: TWO-DIMENSIONAL FINITE ELEMENT ANALYSIS,
Virginia Inst. of Marine Science, Gloucester Point.
C. S. Fang, S. N. Wang, and W. Harrison.
Water Resources Research, Vol 8, No 1, p 121-128, February 1972. 4 fig, 14 ref. ONR Nonr-N00014-70-C-000A.

Descriptors: *Groundwater movement, *Beaches, *Numerical analysis, *Water level fluctuations, *Tidal effects, Tides, Mathematical models, Simulation analysis, Water levels, Hydraulic conductivity.
Identifiers: Finite element analysis.

Two-dimensional finite element techniques may be used to model the complicated fluctuations observed in the water table of an ocean beach. The use of triangular elements permits the specification of more realistic boundary conditions than the use of line elements in a one-dimensional model. Results obtained from the two-dimensional model for the region close to the ocean compare more favorably with field data than results obtained from the one-dimensional finite element model. (Knapp-USGS)
W72-05033

ARTIFICIAL RECHARGE OF AQUIFERS (ALIMENTATION ARTIFICIELLE DES NAPPES),
Electroconsult, Milan (Italy).
For primary bibliographic entry see Field 04B.
W72-05044

SEEPAGE THROUGH SATURATED AND UNSATURATED LAYERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02G.
W72-05045

NUMERICAL MODELING OF UNSATURATED GROUNDWATER FLOW INCLUDING EFFECTS OF EVAPOTRANSPIRATION,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 02G.
W72-05089

STREAMFLOW, GROUNDWATER AND GROUND RESPONSE DATA--VOLUME II, VENEZUELAN INTERNATIONAL METEOROLOGICAL AND HYDROLOGICAL EXPERIMENT (VIMHEX) HYDROLOGY REPORT,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W72-05096

2G. Water in Soils

RESULTS OF HYDRAULIC CONDUCTIVITY MEASUREMENTS IN THE UNSATURATED STATE (IN GERMAN),
Technische Universitaet, Hanover (West Germany). Institut fuer Bodenkunde.
H. H. Becher.
Z Pflanzenernaehr Bodenk. 128 (3): 227-234. 1971. Illus. English summary.
Identifiers: Conductivity, Hydraulic, Measurements, Unsaturated.

The results obtained from several soils of the texture classes sand, silt (loess), and clay are discussed with respect to structure and texture. The accuracy and time consumption of the method are considered.--Copyright 1971, Biological Abstracts, Inc.
W72-04781

STATISTICAL GEOMETRY OF POROUS MEDIA,
Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.
A. E. Scheidegger.
Available from the National Technical Information Service, Springfield, Va. 22151, as PB-206 809, $3.00 in paper copy, $0.95 in microfiche. Final Report UILU-ENG 71-5001, July 1971. 106 p. OWRR C-1613 (No. 3146) (1).

Descriptors: *Porous media, *Statistical models, *Dispersion, *Model studies, *Porosity, Flow.
Identifiers: *Statistical geometry.

Random maze and branching type models of flow through porous media were investigated in three demensions. It is shown that random maze models, if mixing in each link of the maze is permitted, and branching type models, where all free ends are randomly growing, account qualitatively and quantitatively for the mechanical dispersion effects that are observed in flow through porous media. (Mortensen-Illinois)
W72-04783

FINITE DIFFERENCE SOLUTIONS OF AXISYMMETRIC INFILTRATION THROUGH PARTIALLY SATURATED POROUS MEDIA,
Utah State Univ., Logan. Coll. of Engineering.
C. -Y. Wei, and R. W. Jeppson.
Utah Water Research Laboratory Report PRWG59c-6, April 1971. 64 p, 55 fig, 2 tab, 56 ref, 2 append. Agric Res. Service Agreement No. 12-14-100-9715 (41).

Descriptors: *Groundwater movement, *Porous media, *Infiltration, *Mathematical models, Computers, Input-output analysis, Darcys law, Pervious soils, Transmissivity, Water table, Water spreading, Permeability Flow rates, Analytical techniques, Computer programs.
Identifiers: *Axisymmetric infiltration.

Solutions were obtained to the problem of steady-state partially saturated infiltration of moisture applied over a horizontal source circle which moves through homogeneous soils toward a water table. A commonly accepted relationship between relative permeability and capillary pressure was utilized in conjunction with Darcy's law to formulate the mathematical model. The solutions utilized an inverse formulation and were obtained by finite difference. The 'spreading effect' due to the radial movement of moisture caused a higher infiltration rate for the axisymmetric case than for the one-dimensional case. The radial movement of moisture caused the streamlines to spread radially from the source circle toward the water table. The maximum radius of the stream surface at the water table contains 95 percent of the total flux. The moisture content on the ground surface beyond the source circle decreases as the distance from the source circle increases. A definite edge effect causing a high infiltration rate at the edge of the source circle exists. (Woodard-USGS)
W72-04805

SOIL-DESICCATION FEATURES IN SOUTH DAKOTA DEPRESSIONS,
South Dakota State Univ., Brookings. Dept. of Plant Science.
E. M. White.
Journal of Geology, Vol 80, No 1, p 106-111, January 1972. 2 fig, 17 ref.

Descriptors: *Playas, *South Dakota, *Potholes, *Expansive soils, *Cracking, Cracks, Clays, Expansive clays, Drying, Wetting, Mud, Silts, Soil structure, Soil-water-plant relationships.
Identifiers: *Desiccation cracks, Mud cracks.

Soils of playa-like depressions in South Dakota develop desiccation cracks and microrelief features with characteristics which are determined by soil texture, depression flooding rate, and depth of drying and wetting. Major cracks are wider in clay soils than in coarser-textured soils and increase in size with the depth of drying. Swelling of soil below cracks that collect rapid runoff helps to widen the crack and cause small circular slump pits on nearly level surfaces or open-crack striped patterns on sloping edges of depressions. Drainage of the depression slows down flooding, and the soil moistens gradually from the surface downward so the cracks are closed by swelling and do not collect water. With drainage, gilgai microrelief forms only if the depression has clay soils. (Knapp-USGS)
W72-04812

TH ROLE OF ANIMALS IN EARTH-SURFACE MODELING PROCESSES,
Polskie Towarzystwo Przyrodnkow im Kopernika, Warsaw.
Edmund Jonica.
Wszechswiat. 7/8. 189-190. 1970. Illus.
Identifiers: Animals, Earth, Modeling, Processes, Surface.

The surface of the earth is subject to changes due to the activity of animals. Most common here is loose material formed as a result of animal activity followed by soil erosion, but favorable changes also occur such as better irrigation, aeration and ventilation of the soil.--Copyright 1971, Biological Abstracts, Inc.
W72-04876

THE AMELIORATION OF GLEY AND PSEUDOGLEY SOILS,
California Univ., Davis. Dept. of Water Science and Engineering.
J. N. Luthin.
International Society of Soil Science Commissions V and VI 1971, Manuscript No. 3. 6 p, 21 ref. OWRR A-031-CAL (1).

Descriptors: *Drainage, *Excess water (Soils), Clays, *Acidic soils, Hydrogen sulfide, Surface drainage, Subsurface drainage, California.
Identifiers: Imperial Valley (Calif), *Gley, *Pseudogley.

Excessive wetness seems to be the most important problem in the utilization of gley and pseudo-gley soils. Drainage design must be based on the sequence of layering. In two-layered soils having a less permeable subsoil, placement of the drain in the less permeable layer usually does not improve

the drainage. Improved surface drainage should be part of the program to control the soil wetness. The acid sulphate reaction which causes increased soil acidity and may result in the production of hydrogen sulphide gas occurs in many soils where the soil is excessively wet during part of the year.
W72-04899

CONTRIBUTIONS TO THE GENESIS AND CLASSIFICATION OF MARSH SOILS: II. ON THE SULPHUR METABOLISM OF MUDS AND SALT MARSHES, (IN GERMAN),
Kiel Univ. (West Germany). Institut fuer Pflanzenernaehrung und Bodenkunde.
Gerhard Brummer, Hans Siegfried Grunwaldt, and Diedrich Schroeder.
Z Pflanzenernaehr Bodenk. 128 (3): 208-220. 1971. Illus. English summary.
Identifiers: Classification, Genesis, Marsh, Marshes, Metabolism, Microorganisms, Muds, Oxidation, Reduction, Salt, Soils, Sulfur.

In the mud sulfate S from sea water is reduced by microorganisms and insoluble iron sulfide and elemental S accumulates. Intensity and extent of reduction and accumulation in mud depend on the content of organic matter, free Fe, and clay. Accordingly significant positive correlations exist between these characteristics and the contents of sulfide S and total S. With the mud growing out of the range of daily flooding, oxidation processes take place and salt marshes are formed. Reduced inorganic S compounds are converted into H2SO4, which dissolves equivalent amounts of carbonates. In areas where oxidation has taken place losses of carbonates from 2.0-2.5% amounting up to about 1/3 of the original carbonate content of the mud. If salt marshes with high content of decomposable organic matter are submerged by sea water or heavy rainfall sulfate reduction processes again take place. Over a longer period of time in the foreland carbonate free soils can be formed by recurrently alternating reduction and oxidation of mud and salt marshes in combination with the attack of decomposition products of organic matter.--Copyright 1971, Biological Abstracts, Inc.
W72-04924

CATION ADSORPTION IN ONE-DIMENSIONAL FLOW THROUGH SOILS: A NUMERICAL SOLUTION,
Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.
S.-H. Lai, and J. J. Jurinak.
Water Resources Research, Vol 8, No 1, p 99-107, February 1972. 9 fig, 1 tab, 15 ref. FWQA WP-01492-01.

Descriptors: *Cation adsorption, *Numerical analysis, *Soil chemistry, Dispersion, Adsorption, Soil water movement, Clays, Ion exchange.

A numerical method was developed to solve the problem of the cation adsorption operation involving a general nonlinear exchange function. The method may be applied to solve the cation adsorption operation involving five different types of exchange functions. The adsorption of a cation depends on the equilibrium behavior of the counterions, which is defined by the exchange function. The separation factor is used as an index of the adsorption operation. (Knapp-USGS)
W72-05031

THE MEASUREMENT OF SMALL SOIL DISPLACEMENTS ON A DUTCH HILLSLOPE,
Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
J. D. Nieuwenhuis, and D. Kleinendorst.
Engineering Geology, Vol 5, No 4, p 271-289, December 1971. 14 fig, 1 tab, 4 ref, 2 append.

Descriptors: *Creep, *Mass wasting, *Slopes, *Soil erosion, *Instrumentation, Landslides, Soil physical properties, Measurement.
Identifiers: *Soil creep.

To measure soil creep, a number of flat hollow cylinders equal in weight to soil they replace were installed at different depths below the surface of a 47% slope developed over Maestrichitian chalk overlain by a poorly sorted cover. The displacements of the cylinders were recorded for three years. The estimated error (twice the standard deviation) of the measurements of the horizontal component of the displacements is less than 0.4 mm; the error in the vertical component is less than 0.3 mm. Significant displacements were measured only in the upper 20 cm. The movements are spasmodic and parallel to the slope. The mean velocity of the top soil is 1 mm/year. (Knapp-USGS)
W72-05040

COMPLEXES OF HALLOYSITE WITH ORGANIC COMPOUNDS,
Otago Univ., Dunedin (New Zealand). Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W72-05043

SEEPAGE THROUGH SATURATED AND UNSATURATED LAYERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
G. Kovacs.
International Association of Scientific Hydrology Bulletin, Vol 16, No 2, p 27-40, June 1971. 8 fig.

Descriptors: *Seepage, *Saturated flow, *Unsaturated flow, *Groundwater movement, Model studies, Soil water movement, Infiltration, Recharge, Hydraulic models.

A unified method is suitable to characterize all kinds of seepage. The various types of seepage are classified as follows: seepage through saturated porous media (which includes turbulent seepage), transition flow, laminar seepage, microseepage, and seepage in the unsaturated zone. A series of dimensionless numbers is formed as a quotient of the dominating resistive force and determined as a ratio of the acting main resistive force to gravity for reducing the general form of the movement equations. A physical model constructed from straight pipes to simulate the actual geometry of pores was the basis of investigation of the various types of seepage. Checking of the proposed model suggested that the pipes must be constructed using two different diameters. The relationship between velocity and hydraulic gradient differs in the various zones of seepage. Darcy's coefficient of permeability has to be supplemented by a factor characterizing the state of flow, including all effects which differ from laminar seepage. Detailed equations are given for describing water movement in unsaturated layers. (Knapp-USGS)
W72-05045

SPECIFIC CONDUCTANCE MODEL FOR NATURAL WATERS AND SOIL SOLUTIONS OF LIMITED SALINITY LEVELS,
California Univ., Davis. Dept. of Water Science and Engineering.
K. K. Tanji, and J. W. Biggar.
Water Resources Research, Vol 8, No 1, p 145-153, February 1972. 4 tab, 13 ref.

Descriptors: *Conductivity, *Soil water, *Aqueous solutions, *Saline water, *Electrical conductance, Solutes, Water chemistry, Water properties, Ions, Water temperature.
Identifiers: *Specific conductance.

The specific conductance of waters and soil solutions may be estimated with a simplified multicomponent conductance model. This model considers solute composition and concentration and a lumped coefficient for ionic interactions, retardation effects, and ion association. The effect of temperature on specific conductance is also considered. Comparison of measured and calculated specific conductances indicates that this empirical model is most applicable to waters and soil solutions with limited salinity levels. Conductance is approximately related to the total soluble cations and the total dissolved salts. (Knapp-USGS)
W72-05053

NUMERICAL MODELING OF UNSATURATED GROUNDWATER FLOW INCLUDING EFFECTS OF EVAPOTRANSPIRATION,
Kansas Water Resources Research Inst., Manhattan.
D. W. Green, H. Dabiri, and J. D. Khare.
Available from the National Technical Information Service as PB-207 135, $3.00 in paper copy, $0.95 in microfiche. Completion Report, January 1972. Contribution No 72, 185 p, 30 fig, 8 tab, 49 ref, append. OWRR B-018-KAN (1).

Descriptors: *Computer model, *Evapotranspiration, *Unsaturated flow, *Numerical analysis, *Model studies, Kansas, *Porous media, Water loss, Transpiration, Evaporation, Soil moisture, Permeability.
Identifiers: *Ohm's law, Neutron logging device, Two-phase flow.

A mathematical model describing two-phase flow in porous media has been developed. The model, which consists of describing differential equations and an algorithm for their numerical solution, is applicable to the problem of one dimensional, vertical ground water movement in unsaturated soils, considering evaporation and transpiration losses (evapotranspiration). The model is a major extension of one presented earlier by the authors which describes unsaturated flow in the absence of evapotranspiration. The second order, non linear, partial differential equations describing water-air flow through porous media have been extended to include water losses due to unsteady-state evapotranspiration. The basis of the extension is an analogy to Ohm's law. The water transport in the soil atmosphere or the soil plant-atmosphere system has been considered to take place due to the existence of successively decreasing driving-force potentials from the soil to the atmosphere. The describing differential equations were converted to finite difference form and solved, with the aid of a digital computer, using an iterative implicit procedure. The model includes effective permeabilities of each phase and capillary pressure as functions of liquid saturation. Also, the effects of gravity and variable rock and fluid properties are included. The applicability of the model was evaluated by comparison of computed results with experimental field data taken by the United States Geological Survey. These data were obtained using a neutron logging device to measure soil moisture as a function of depth and time in a sand dune area of southwestern Kansas. Both transpiration and evaporation were active in the test area. Good agreement between calculated results and the experimental data was obtained. With the mathematical model developed in this work it is possible to study interactions between variables that are important to the soil-moisture behavior in the soil-plant-atmosphere system. The model potentially is a versatile management tool which could be used to help predict performance of ground-water systems. (Green-KWRRI)
W72-05089

LEGAL ASPECTS OF WATER SALVAGE,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 06E.
W72-05098

A STUDY OF THE INFLUENCE OF NITROGEN AND PHOSPHORUS FERTILIZERS ON THE CORN GROWN ON THE ALLUVIAL SOILS OF THE DANUBE FLOODED AREA,
Institutul Agronomic, Bucharest (Rumania).
S. Dimancea, and Laza Steliana.
Lucrari Stiint Inst Agron 'N Balcescu' Sera. 12: 121-129. 1969. English, French, and Russian summaries.

Identifiers: Alluvial, Corn-M, Danube, Fertilizers, Flooded, Grown, Nitrogen, Phosphorus, Romania, Soils, Yield.

The efficiency of N, P and K fertilizer supplied to the 'HD-311' hybrid corn on an alluvial soil was investigated in 1965, 1966 and 1967. The texture, the chemical composition and the fertility of the soil differed from place to place. The soil was alkaline and slightly humiferous and slightly to moderately supplied with P, K and Ca. Soil texture ranged from sandy loamy to clay-loamy while the water table was 1-1.60 m deep accordingly. The highest yields were obtained with N96 P64 K40 kg/ha. However, the number of grains per 1 kg of active matter was higher with moderate to high rates of nitrogen (N48-N96). Additional P to N48 and N96 rates did not increase yield.--Copyright 1971, Biological Abstracts, Inc.
W72-05116

HYDRODYNAMIC DISPERSION IN AGGREGATED MEDIA: 1. THEORY,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
J. B. Passioura.
Soil Sci. 111 (6): 339-344. 1971. Illus.
Identifiers: Aggregated, Diffusion, Dispersion, Dynamic, Flow, Media, Solute, Theory, Velocity.

When one solution displaces another from a saturated aggregated medium, viscous flow takes place effectively only in the voids between the aggregates and consequently movement of solutes within the aggregates occurs only by diffusion. Some of the implications of these constraints are explored. A longitudinal dispersion coefficient is derived, which for large mean velocities of flow depends on the squares of the velocity and of the average diameter of the aggregates. The applicability of the coefficient and its effect on breakthrough curves are discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-05122

EFFECT OF WATER TABLE DEPTH AND FLOODING ON YIELD OF MILLET,
Agricultural Research Service, Raleigh, N.C.
R. E. Williamson, C. R. Wiley, and T. N. Gray.
Agronomy Journal, Vol 61, No 2, p 310-313, March-April, 1969. 4 fig, 2 tab, 16 ref.

Descriptors: *Drainage, *Aeration, Flooding, Water table, Agronomy, Crop production.
Identifiers: Millet.

Yields of millet (Pennisetum glaucum (L.)R. Br.) grown in both sheltered and nonsheltered soil tanks increased with water table depth to a depth of 76 cm. In the sheltered tanks yields were similar for all water table depths greater than 61 cm. The N, P, and K contents of plants grown with water tables at 15 or 30 cm in the sheltered tanks were significantly lower than for deeper water table depths. Except for the tanks with 15 and 30-cm water tables, the oxygen content by volume was generally above 18% at the 15-cm depth, indicating that the region of greatest root mass (0 to 8 cm) was probably well aerated. Since yields were affected by water table depths down to 76 cm, it appears that the few roots extending below the 8-cm depth were nevertheless necessary to supply nutrients to the plant. Yield data suggest that O2 was low in a portion of the root zone where water tables were less than 76 cm below the surface. Two days of flooding 4 weeks before the first harvest reduced the first harvest yield 40%, but did not affect the second harvest yield. Flooding at earlier or later dates caused less yield reduction. (Skogerboe-Colorado)
W72-05124

GRAVITY SEGREGATION DURING MISCIBLE DISPLACEMENT EXPERIMENTS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
D. A. Rose, and J. B. Passioura.
Soil Sci. 111 (4): 258-265. 1971. Illus.
Identifiers: Density, Displacement, Flow, Gravity, Miscible, Permeability, Segregation, Velocity.

When the liquid resident in a horizontal bed of porous material is displaced by another liquid of different density, the resulting dispersion of solute is enhanced by the formation of tongue of denser liquid undershooting the lighter liquid. The phenomenon, known as gravity segregation, is responsible for many anomalous results in the literature on hydrodynamic dispersion of solutes. The size of the gravity segregation effect depends directly on the permeability of the bed, the difference in density between the two liquids, the thickness of the bed over which this density difference operates, and inversely on the flow velocity, and the length of the bed. The main features of gravity segregation were illustrated in a series of miscible displacement experiments using 2 sizes of glass spheres (210-250 micron and 420-500 micron diameter), 2 flow velocities, and 4 density differences obtained from pairs of NaCl solutions and water. Increased dispersion of solute was noted with a density difference as small as 2 x 10-4 g cm-3, corresponding to a concentration difference of 0.005 N NaCl.--Copyright 1971, Biological Abstracts, Inc.
W72-05126

THE ANALYSIS OF EXPERIMENTS ON HYDRODYNAMIC DISPERSION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
D. A. Rose, and J. B. Passioura.
Soil Sci. 111 (4): 252-257. 1971. Illus.
Identifiers: Diffusion, Dispersion, Equation, Hydrodynamic.

An objective method for analyzing experiments on hydrodynamic dispersion is presented based on the logarithmic-normal transformation of a numerical solution of the equation of longitudinal dispersion in a finite column. Experimental data that satisfy the conditions of the analysis fall on a straight line when transformed, the slope of which is a unique function of Brenner number. Several conditions that cause deviations from a straight line are illustrated and discussed, as are alternative methods of analysis.--Copyright 1971, Biological Abstracts, Inc.
W72-05128

THE EFFECT OF WATER ACTIVITY ON ION EXCHANGE SELECTIVITY IN CLAYS,
Louvain Univ. (Belgium).
Henri Laudelout, Robert Van Bladel, and Jose Robeyns.
Soil Sci. 111 (4): 211-213. 1971. Illus.
Identifiers: Cesium, Clays, Exchange, Ion, Selectivity, Sodium.

Ion-exchange equilibria for the pair Na-Cs were studied on a montmorillonite clay at a temperature of 25 deg C. and at different normalities of the equilibrium solution. The values of the selectivity coefficient Kc corrected for the activity coefficients of the electrolytes in the mixed solution were determined in the Cs trace region. A linear relationship was observed between in Kc and ln aw (water activity) and the experimental value obtained for the difference of the hydration numbers is in good agreement with the one that can be calculated from other techniques.--Copyright 1971, Biological Abstracts, Inc.
W72-05135

ANNUAL SOIL MOISTURE-TEMPERATURE PATTERNS AS INFLUENCED BY IRRIGATION,
Forest Service (USDA), Syracuse, N.Y.
Raymond E. Leonard, Albert L. Leaf, John V. Berglund, and Phillip J. Craul.
Soil Sci. 111 (4): 220-227. 1971. Illus.
Identifiers: Annual, Cover, Forest, Irrigation, Moisture, Patterns, Pinus-Resinosa-G, Soil, Temperature.

Irrigation water was applied at the rate of 5-area-cm every 15 days from June 1 through Sept. 1 for 3 yr to a sandy out-wash soil in northern New York with a forest cover of 40-yr-old red pine (Pinus resinosa Ait.). Frequent monitoring of soil moisture and soil temperature at several depths during the entire period illustrates the annual patterns of these soil properties and their changes resulting from treatment. The addition of 35-area-cm of water/yr resulted in maintaining soil moisture levels approaching those shortly after spring snow melt. This treatment also modified soil temperature below the 20 cm depth by extending the period of higher temperatures.--Copyright 1971, Biological Abstracts, Inc.
W72-05137

WATER STRESS GRADIENTS IN PLANTS AND SOIL-ROOT SYSTEMS,
Connecticut Agricultural Experiment Station, Windsor. Valley Lab.
H. C. De Roo.
Agronomy Journal, Vol 61, No 4, p 511-515, July-August 1969. 4 fig, 1 tab, 12 ref.

Descriptors: *Soil-water-plant relationships, Tobacco, *Xylem, Moisture stress, Plants, *Hydrostatic pressure.

The plant moisture stresses (PMS) in leaves, shoots, and roots of tobacco were determined as the negative hydrostatic xylem sap pressure in a pressure bomb. In the field, PMS in the midribs of leaves varied with the atmospheric stress and showed a reasonable diurnal course, while PMS of the adventitious roots did not change diurnally. Thus on a hot, sunny day during a dry period a steep PMS gradient between leaves and roots developed, which throughout the night gradually diminished. During the cool, humid early morning hours, leaf and root PMS were about the same. A comparison of root PMS with soil moisture stress, however, revealed an unexpected, steep, inverted gradient. In the greenhouse, small pot-grown plants were observed to verify the field observations. The differences in equilibrated sap pressures or PMS of complete shoots and intact soil-root systems clearly depended upon the relative rates of water adsorption and water loss. In dry Merrimac sandy loam with soil moisture stresses (SMS) higher than about 12 bars, root PMS were lower than SMS, as had been observed in adventitious roots in the field. In moist soil with SMS lower than 12 bars, this situation reversed and a normal moisture stress gradient from soil to root existed. (Skogerboe-Colorado State)
W72-05139

PHYSICS AND BIOPHYSICS OF SOILS, (IN RUSSIAN).
Kolos: Leningrad. 1969. 183 p. Illus. Sbornik Trudov Po Agronomicheskoi Fiziologii, 19.
Identifiers: Aggregate, Anomalies, Biophysics, Book, Diffusion, Filtration, Formation, Moisture, Osmosis, Physics, Retention, Soils, Thermo, Transport.

The nature of water-retaining capacity and moisture conductivity of soil, filtration anomalies of liquids, thermodiffusion and thermal osmosis of liquids in capillaries, thermal moisture transport in nonuniformly moist systems, and the part played by surface forces in the formation of aggregated structure are described. The determination of evaporation by the heat balance method, as well as the results of investigations on the biological ac-

tivity of soils in relation to their physical conditions are discussed. Some new instruments and devices are also described.--Copyright 1971, Biological Abstracts, Inc.
W72-05141

SOIL MOISTURE CONTENT, TILTH, AND SOYBEAN RESPONSE WITH SURFACE AND SUBSURFACE DRAINAGE,
Agricultural Research Service, Wooster, Ohio. Soil and Water Conservation Research Div.
N. R. Fausey, and G. D. Schwab.
Agronomy Journal, Vol 61, No 4, p 554-557, July-August 1969. 5 fig, 5 ref.

Descriptors: *Penetration, *Soil moisture, *Subsurface drainage, *Surface drainage, Soybeans, Root systems, Crop production.
Identifiers: Soil crust.

Soil properties and soybean response were compared for plots having different levels of drainage. The plots were established on a silty clay lakebed soil in northern Ohio. The soil and crop characteristics compared were: (1) average soil moisture content at four depths in the upper 30 cm during the seedbed preparation period (April and May); (2) soil tilth immediately preceding seedbed preparation as expressed by crust properties and resistance to surface penetration; and (3) stand establishment, root and top growth, and soybean yield. On plots with no drainage, crop stand was sparse and crop growth essentially nil. There were long periods with ponded water, and crusting and adverse structure of the surface soil were much in evidence. Among drained plots, there were no measurable differences in crust bulk density and soybean stand. Plots having subsurface or combined surface-subsurface drainage had lower moisture content, less resistance to surface penetration, smaller crust units, taller plants, better developed root systems, and greater yields than plots with surface drainage alone. (Skogerboe-Colorado State)
W72-05145

CONCEPTS OF SOIL MOISTURE AVAILABILITY AND THEIR EFFECT ON SOIL MOISTURE ESTIMATES FROM A METEOROLOGICAL BUDGET,
Department of Agriculture, Ottawa (Ontario). Plant Research Inst.
For primary bibliographic entry see Field 02D.
W72-05149

INFLUENCE OF NO-TILLAGE ON SOIL MOISTURE,
Kentucky Univ., Lexington. Dept. of Agronomy.
R. L. Blevins, Doyle Cook, S. H. Phillips, and R. E. Phillips.
Agron J. 63 (4): 593-596. 1971.
Identifiers: Corn-M, Moisture, Soil, Storage, Tillage, Yield, Zea-Mays-M.

Field studies were conducted to compare the effect of non-tillage versus conventional tillage corn (Zea mays L.) production on soil moisture. The studies were made on a Donerail silt loam in 1968 and 1969 and on a Maury silt loam in 1970. Soil moisture was measured periodically at various depths in the soil profile during the growing seasons. No tillage treatments had higher volumetric moisture contents to a depth of 60 cm during most of the growing season. The greatest differences occurred in the upper 0 to 8-cm depth. Beyond a depth of 60 cm, systems of tillage had little influence on soil moisture during the growing seasons. Soil moisture curves indicate different water withdrawal patterns under the 2 contrasting methods of tillage. The decrease in evaporation and the greater ability to store moisture under no-tillage produces a greater water reserve. This can often carry the crop through periods of short-term drought and avoid the development of detrimental moisture stresses in the plant. The more efficient use of soil moisture by no-tillage is reflected in higher corn yields. This study further substantiates the effectiveness of no-tillage systems of corn production on well to moderately well-drained silt loam soils in Kentucky and other regions with similar climatic regimes.--Copyright 1971, Biological Abstracts, Inc.
W72-05155

IMPORTANCE OF THE MAXIMAL HYGROSCOPIC POINT IN A FACTORIAL ANALYSIS OF THE BIOTOPE OF COLLEMBOLANS (IN FRENCH),
Musee National, Brunoy (France).
G. Vannier.
Rev Ecol Biol Sol. 8 (1): 81-89. 1971. Illus. English summary.
Identifiers: Biotope, Collembolans, Distribution, Factor, Factorial, Hygroscopic, Maximal, Point.

The maximal hygroscopic value of a soil is not generally taken into consideration by ecologists. It is ecologically important because it indicates a change in the water condition of the soil. Two methods are proposed to obtain the value in pF units which locate this point. A constant value was found irrespective of the nature of the substratum where the Collembola are located.--Copyright 1971, Biological Abstracts, Inc.
W72-05178

DECONTAMINATION OF RADIOACTIVELY POISONED WATER WITH PEAT FILTERS, (IN GERMAN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 05G.
W72-05224

INTERMITTENT LEACHING, A RECOMMENDED TECHNIQUE FOR THE RECLAMATION OF SALINE SOILS, (IN SPANISH),
Universidad Nacional del Sur, Bahia Blanca (Argentina).
Pedro Carlos Fernandez.
Rev Invest Agropecuar Ser 3 Clima Suelo. 7 (2): 93-104. 1970. Illus. English summary.
Identifiers: Intermittent, Leaching, Reclamation, Saline, Salinity, Soils, Technique.

An equation was developed that takes into account the displacement of the leaching front with respect to time and distance in a saline porous media, under steady conditions, in a drainage system of parallel drains. Theoretical fronts were calculated using the flow nets constructed by the use of an electrical resistance network and these fronts were compared with experimental fronts determined in a sand tank model. The results of these experiments show the low efficiency of leaching by ponded water. An intermittent leaching program will result in a more uniform decrease in salinity.--Copyright 1971, Biological Abstracts, Inc.
W72-05228

THE AVAILABLE-WATER CAPACITIES OF NORTH AUCKLAND SOILS,
Department of Scientific and Industrial Research. Lower Hutt (New Zealand). Soil Bureau.
M. W. Gradwell.
N Z J Agr Res. 14 (2): 253-287. 1971.
Identifiers: Auckland, Available, Bulk, Capacities, Clay, Density, Loam, New-Zealand, North, Podsol, Silt, Soils.

Available-water capacities of the principal groups of soils of high clay content were determined. Within each main soil group they are markedly uniform. Among the soils on sedimentary parent rocks podzolisation is accompanied by large available-water capacities in the A horizons and smaller ones in some B horizons than are found for unpozolised soils. Of the soils on volcanic parent rocks, the brown loams on basalt have small available-water capacities, and the brown granular soils, on andesitic rocks, large ones. The large available-water capacities of the A horizons of podzols are related to silty textures, but other differences in available-water capacity among soil groups are best explained by other physical properties. These include high dry bulk densities in the B horizons of some pozolised soils, low dry bulk densities in the B horizons of brown granular soils, and considerable volumes of large, easily drained pores in many brown loams.--Copyright 1971, Biological Abstracts, Inc.
W72-05234

2H. Lakes

THE DECLINE OF A ROACH RUTILUS RUTILUS (L.) POPULATION IN CHEW VALLEY LAKE,
Bristol Univ. (England). Dept. of Zoology.
R. S. Wilson.
J Fish Biol. 3 (2): 129-137, 1971. Illus, Map.
Identifiers: Chew, Decline, England, Lake, Ligula-Intestinalis, Parasitism, Population, Roach, Rutilus-Rutilus, Trout, Valley.

A series of nettings for roach in Chew Valley Lake carried out by members of the Zoology Department, Bristol University, has revealed a marked decline in the population between 1965 and 1968. Fish from the main Lake were heavily parasitized with Ligula intestinalis (L.) while those from the inflow pool (Herriott's Pool) were practically free from infection. It is considered that the decline of the roach can be linked to the incidence of Ligula, but that clean fish from the inflow pool may provide breeding stock and maintain the production of fry, which serve as food for the trout.--Copyright 1971, Biological Abstracts, Inc.
W72-04706

PRIMARY PRODUCTION AND CHLOROPHYLL A CONTENT OF NANOPLANKTON IN A EUTROPHIC LAKE,
Lund Univ. (Sweden). Limnological Inst.
For primary bibliographic entry see Field 05C.
W72-04717

VERTICAL DISTRIBUTION OF SOME CILIATED PROTOZOA IN TWO FRESHWATER SEDIMENTS,
Freshwater Biological Association, Ambleside (Sweden).
For primary bibliographic entry see Field 05C.
W72-04718

METHOD FOR THE STORAGE OF SAMPLES FOR DISSOLVED GAS ANALYSES,
Wisconsin Univ., Madison. Water Chemistry Program.
For primary bibliographic entry see Field 05A.
W72-04729

LEVELS OF INORGANIC AND TOTAL PHOSPHORUS IN LAKE SEDIMENTS AS RELATED TO OTHER SEDIMENT PARAMETERS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05C.
W72-04732

SELENIUM IN LAKE SEDIMENTS - ANALYTICAL PROCEDURE AND PRELIMINARY RESULTS,
Wisconsin Univ., Madison. Water Chemistry Program.
For primary bibliographic entry see Field 05A.
W72-04733

EUTROPHICATION OF SMALL RESERVOIRS IN THE GREAT PLAINS,
Nebraska Univ., Lincoln. Dept. of Civil Engineering; and Nebraska Univ., Lincoln. Dept. of Zoology.

For primary bibliographic entry see Field 05C.
W72-04759

EUTROPHICATION OF SMALL RESERVOIRS IN THE GREAT PLAINS,
Nebraska Univ., Lincoln.
For primary bibliographic entry see Field 05C.
W72-04761

POPULATION DYNAMICS OF SELECTED ZOOPLANKTON IN THREE OLIGOTROPHIC OREGON LAKES,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
For primary bibliographic entry see Field 05C.
W72-04763

EMIGRATION OF JUVENILE SALMON AND TROUT FROM BROWNLEE RESERVOIR, 1963--65,
Bureau of Commercial Fisheries, Seattle, Wash. Seattle Biological Lab.
Carl W. Sims.
US Fish Wildl Serv Fish Bull. 68 (2): 245-259. 1971. Illus, Maps.
Identifiers: Brownlee, Emigration, Juvenile, Reservoir, Salmon, Scoop, Traps, Trout.

Floating scoop traps below Brownlee Dam captured samples of marked and unmarked salmon and trout that had left the impoundment from July 1963 through Aug. 1965; estimates of emigration were based on these samples. Success of passage varied among years and populations and was affected by the environment in the reservoir during out-migration. Downstream migrants that entered the reservoir early in the season were more successful than those that entered later. Emigration was also more successful when the reservoir level was low.--Copyright 1971, Biological Abstracts, Inc.
W72-04767

DISTRIBUTION AND MOVEMENT OF JUVENILE SALMON IN BROWNLEE RESERVOIR, 1962-65,
Bureau of Commercial Fisheries, Seattle, Wash. Seattle Biological Lab.
Joseph T. Durkin, Donn L. Park, and Robert F. Raleigh.
US Fish Wildl Serv Fish Bull. 68 (2): 219-243. 1971. Illus, Maps.
Identifiers: Brownlee, Distribution, Juvenile, Movement, Oncorhynchus-Kisutch, Oncorhynchus-Nerka, Oncorhynchus-Tsawytscha, Reservoir, Salmon.

Juvenile salmon-chinook (Oncorhynchus tshawytscha), coho (O. kisutch), and sockeye and kokanee (O. nerka)-were studied. Their rates and direction of movement, spatial distribution, and successful passage to the outlet varied in relation to surface currents, water temperature, and dissolved O2 concentrations. Some juvenile salmon stayed in Brownlee Reservoir through the summer, fall, and early winter; the percentage varied between years. The percentages were highest in years with high water level and retarded, disoriented flows during the spring migration. Salmon that held over eventually concentrated in rather restricted areas of the reservoir through the summer and early fall, owing to high epilimnion temperatures and to low concentrations of dissolved O2 that extended into the epilimnion from the hypolimnion. When the water level was low and reservoir currents were oriented downstream, loss of orientation by juvenile salmon was least and movement through the reservoir was most rapid. These reservoir conditions varied, but salmon populations that migrated early in the year were most likely to encounter them.--Copyright 1971, Biological Abstracts, Inc.
W72-04768

MIGRATION OF JUVENILE SALMON AND TROUT INTO BROWNLEE RESERVOIR, 1962--65,
Bureau of Commercial Fisheries, Seattle, Wash. Seattle Biological Lab.
Richard F. Krcma, and Robert F. Raleigh.
US Fish Wildl Serv Fish Bull. 68 (2): 203-217. 1971. Illus.
Identifiers: Brownlee, Juvenile, Migration, Oncorhynchus-Kisutch, Oncorhynchus-Nerka, Oncorhynchus-Tshawytscha, Reservoir, Salmo-Gairdneri, Salmon, Trout.

Migrations of juvenile shinook salmon (Oncorhynchus tshawytscha), coho salmon (O. kisutch), sockeye and kokanee salmon (O. nerka), and rainbow trout (Salmo gairdneri) from the Snake and Weiser Rivers and from Eagle Creek were studied. Populations of fish were sampled with floating traps above the reservoir and a fixed louver trap in Eagle Creek near the lower end of Brownlee Reservoir. Age and length of fish, timing of migration, and numbers of fish of native or hatchery origin were determined. This information was needed to evaluate the effects of Brownlee Reservoir on migrations of anadromous fish.--Copyright 1971, Biological Abstracts, Inc.
W72-04771

INLAND LAKE DREDGING EVALUATION.
Strand (John A.) and Associates, Inc., Madison, Wis.
For primary bibliographic entry see Field 08C.
W72-04778

WATER QUALITY OFFICE.
Environmental Protection Agency, San Francisco, Calif. Water Quality Office.
For primary bibliographic entry see Field 05C.
W72-04791

COASTAL SEDIMENTATION OF SOUTHEASTERN LAKE MICHIGAN, FIELD TRIP GUIDEBOOK,
Western Michigan Univ., Kalamazoo. Dept. of Geology.
For primary bibliographic entry see Field 02J.
W72-04807

ELECTION MICROGRAPHS OF LAKE KINNERET SEDIMENTS,
Hebrew Univ., Rehovoth (Israel). Dept. of Soil Science.
For primary bibliographic entry see Field 02J.
W72-04810

THERMAL MAPPING OF SELECTED SITES IN THE LAKE KINNERET REGION,
Tel Aviv Univ. (Israel). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 07B.
W72-04811

HYDROLOGIC DATA FOR HORSESHOE LAKE, ARKANSAS, AND VICINITY,
Geological Survey, Little Rock, Ark. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-04822

FARMDALIAN LAKE DEPOSITS AND FAUNAS IN NORTHERN ILLINOIS,
Illinois State Geological Survey, Urbana.
H. B. Willman, A. B. Leonard, and J. C. Frye.
Illinois State Geological Survey, Circular 467, 1971. 12 p, 2 fig, 17 ref.

Descriptors: *Lake beds, *Geologic time, *Stratigraphy, *Geologic formations, *Illinois, Hydrogeology, Lakes, Dry beds, Dating, Age, History, Excavation.
Identifiers: Farmdalian lake deposits, Faunas.

A recent exposure at Morris, Illinois, reveals that an extensive lake was present in the upper Illinois Valley during Farmdalian time. The exposure and the previously described Wedron Section are the basis for definition of a new unit, the Peddicord Formation. The formation is a massive gray silt overlain by pink silt. The molluscan fauna from the Peddicord Formation at Morris significantly expands knowledge of Farmdalian aquatic faunas, previously known only from Wedron. These faunas indicate the presence of a lake of cool permanent water and confirm the fact that the Farmdalian, although a time of extensive glacial withdrawal, was characterized by a cool, moist climate. (Woodard-USGS)
W72-04834

NATURAL CONDITIONS AND AQUATIC LIFE OF THE BRATSK RESERVOIR (FORMIROVANIYE PRIRODNYKH USLOVIY I ZHIZNI BRATSKOGO VODOKHRANILISHCHA).

Izdatel ' stvo 'Nauka', Moscow, G. I. Galaziy, editor, 1970. 280 p.

Descriptors: *Aquatic life, *Aquatic bacteria, *Aquatic animals, *Aquatic plants, *Reservoir stages, Early impoundment, Biomass, Aquatic algae, Phytoplankton, Zooplankton, Fish populations, Water temperature, Thermal stratification, Oxidation, Organic matter, Water quality, Water chemistry, Water pollution sources, Meteorological data, Seasonal.
Identifiers: *USSR, *Irkutsk Oblast, *Bratsk Reservoir, Angara River, Oka River, Hydrobiology, Bacteriology, Saprophytes, Sturgeon, Metalimnion.

This collection of 8 papers deals primarily with biological aspects of aquatic life in the Bratsk Reservoir, Eastern Siberia, (Irkutsk Oblast)--the largest manmade lake in the world. The papers, may be used as a basis for forecasting water quality of the reservoir for drinking-water supply and industrial use, and for reclaiming the reservoir as a fishery. Subjects examined include: (1) seasonal meteorological conditions in the region of the reservoir; (2) formation of phytoplankton in the reservoir; (3) aquatic bacteria in the reservoir (1965); (4) establishment of zooplankton in the reservoir during the first two years of impoundment (1962-63); (5) fish population and distribution in the Oka River section of the reservoir; (6) sterlet in the reservoir and Angara River; (7) long-term water-quality characteristics of the reservoir and forecast of organic matter accumulation; and (8) water quality of the reservoir during the first years of impoundment (1962-64). The collection is of particular value to hydrobiologists, ichthyologists, hydrologists, climatologists, zoologists and botanists. (See also W72-04854 thru W72-04860) (Josefson-USGS)
W72-04853

SEASONAL METEOROLOGICAL CONDITIONS IN THE REGION OF THE BRATSK RESERVOIR (SEZONNYYE METEOROLOGICHESKIYE USLOVIYA V RAYONE BRATSKOGO VODOKHRANILISHCHA),
Limnologicheskii Institut, Irkutsk (USSR).
V. G. Razuvanov.
In: Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha; Izdatel'stvo 'Nauka', Moscow, p 7-25, 1970. 3 fig, 6 tab, 8 ref.

Descriptors: *Reservoirs, *Reservoir construction, *Reservoir stages, *Meteorology, *Meteorological data, Climatology, Topography, Radiation, Albedo, Air temperature, Moisture content, Precipitation (Atmospheric), Snow cover, Winds, Wind velocity, Seasonal.
Identifiers: *USSR, *Irkutsk Oblast, *Bratsk Reservoir, Angara River.

Meteorological conditions which existed prior to construction of the Bratsk Reservoir, Eastern

Siberia, (Irkutsk Oblast) and during its impoundment are examined. A brief description is given of annual changes in the radiation regime, air temperature and wind conditions, and moisture content of the area. Applicability of computation methods to determine possible radiation totals for the reservoir is based on field observations at the reservoir and on data available in the literature. The albedo of water in the coastal zone differs somewhat from the theoretical values at high solar altitudes. Air temperature above the water surface differs sharply from that on shore. This is particularly evident in spring and summer when average 10-day air-temperature differences between the shore and reservoir may reach 7 deg C (beginning of June). Daily air-temperature fluctuations over the water are considerably less than those over the shore. Besides lower temperatures, a reduced threat of frost in the fall, and changes in the radiation regime, construction of the reservoir has resulted in the formation and development in the coastal zone of a breeze pattern of quite high frequency and intensity. (See also W72-04853) (Josefson-USGS)
W72-04854

FORMATION OF PHYTOPLANKTON IN THE BRATSK RESERVOIR (FORMIROVANIYE FITOPLANKTONA BRATSKOGO VODOKHRANILISHCHA),
Limnologicheskii Institut, Irkutsk (USSR).
For primary bibliographic entry see Field 05C.
W72-04855

AQUATIC BACTERIA IN THE BRATSK RESERVOIR IN 1965 (BAKTERIOPLANKTON BRATSKOGO VODOKHRANILISHCHA V 1965 G.),
Limnologicheskii Institut, Irkutsk (USSR).
O. M. Kozhova, and L. M. Mamontova.
In: Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha; Izdatel 'stvo 'Nauka', Moscow, p 161-177, 1970. 5 fig, 5 tab, 18 ref.

Descriptors: *Aquatic microbiology, *Aquatic bacteria, *Reservoirs, *Reservoir stages, *Early impoundment, Biomass, Aquatic productivity, Reproduction, Water temperature, Epilimnion, Benthos, Organic matter, Carbon, Photosynthesis, Ice, Seasonal.
Identifiers: *USSR, *Irkutsk Oblast, *Bratsk Reservoir, Angara River, Oka River, Biosynthesis, Saprophytes.

The total number of bacteria in the Bratsk Reservoir, Eastern Siberia, during the fourth year of impoundment (1965-66) varied between 0.1 and 4.1 million kl/ml. The average number of bacteria in open water was 860,000 kl/ml or 258 mg/cu m. The number of bacteria under ice cover was 250,000 kl/ml or 75 mg/cu m. No significant or long-term seasonal changes in bacteria numbers in open water were observed. Bacteria of the reservoir are generally concentrated in the epilimnion, with smaller numbers in benthonic waters. Generation time of the bacteria is 7-233 hours, the average being 30 hours. The number of saprophytes in 1 ml of water ranges from 24 to 7,713 and averages 557. Average number of bacteria in the surface layer of open water in 1964 ranged from 963,000 to 1,381,000 kl/ml and in 1965, from 732,000 to 1,143,000 kl/ml. The numbers of bacteria in benthonic waters in 1964 averaged 1,952,000 kl/ml and in 1965, 753,000-809,000 kl/ml. Average daily production of carbon by aquatic bacteria during the 1964 and 1965 growing periods was almost the same (about 14 mg C/cu m). Total organic matter oxidized by the bacteria in 1965 was 146 mg C/cu m or 16,000 metric tons of carbon. These values are 4.5 times higher than the total production of photosynthesis during the same period. (See also W72-04853) (Josefson-USGS)
W72-04856

FORMATION OF ZOOPLANKTON IN THE BRATSK RESERVOIR DURING THE FIRST TWO YEARS OF IMPOUNDMENT, 1962-63 (FORMIROVANIYE ZOOPLANKTONA V PERVYYE DVA GODA ZAPOLNENIYA BRATSKOGO VODOKHRANILISHCHA (1962-1963 GG.)),
N. V. Vershinin, and F. F. Syrigina.
In: Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha; Izdatel 'stvo 'Nauka', Moscow, p 178-189, 1970. 2 fig, 4 tab, 9 ref.

Descriptors: *Aquatic animals, *Zooplankton, *Reservoirs, *Reservoir stages, *Early impoundment, Biomass, Rotifers, Crustaceans, Copepods, Daphnia, Water temperature, Thermal stratification, Benthos, Oxidation, Oxygen, Seasonal.
Identifiers: *USSR, *Irkutsk Oblast, *Bratsk Reservoir, Angara River.

The Bratsk Reservoir in Eastern Siberia (Irkutsk Oblast) is the second in the Angara River cascade of powerplants. On the basis of its hydrologic and hydrochemical regime, the reservoir is divided into two main sections: the Angara and the Oka, formed by the Angara and Oka Rivers, respectively. Zooplankton of the reservoir during the first two years of impoundment (1962-63) was composed dominantly of rotifers in the upper reaches of the reservoir and of crustaceans of flood-plain lakes and of Lake Baykal in the middle and lower reaches. Zooplankton population of the reservoir increases in summer and decreases in spring and fall. Qualitatively and quantitatively, rotifers are predominant in spring and fall, and crustaceans are predominant in summer. Zooplankton biomass in the Angara section increases in the direction of the dam, while that in the Oka section is seen to increase in upper reaches of the reservoir. In coastal areas and inlets the biomass is 32 g/cu m. Construction of the reservoir has increased the zooplankton population. In July and August 1961, average biomass of zooplankton in the Angara River was 79 mg/cu m and that in the Oka River, 171 mg/cu m. In 1962 average biomass in the Angara section of the reservoir was 925 mg/cu m and that in the Oka section, 678 mg/cu m. In 1963 average biomass in the Angara section was 445 mg/cu m. (See also W72-04853) (Josefson-USGS)
W72-04857

FISH POPULATION AND DISTRIBUTION IN THE OKA RIVER SECTION OF THE BRATSK RESERVOIR (RAZMESHCHENIYE I CHISLENNOST' RYB V OKINSKOY CHASTI BRATSKOGO VODOKHRANILISHCHA),
Limnologicheskii Institut, Irkutsk (USSR).
A. M. Mamontov.
In: Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha; Izdatel 'stvo 'Nauka', Moscow, p 190-194, 1970. 1 tab.

Descriptors: *Fish, *Fish populations, *Fish establishment, *Reservoirs, *Reservoir stages, Pre-impoundment, Early impoundment, Streamflow, Regulation, Water temperature, Fish migration, Fish reproduction, Spawning, Fish eggs, Sexual maturity, Salmon, Pikes, Perches.
Identifiers: *USSR, *Irkutsk Oblast, *Bratsk Reservoir, Oka River, Sturgeon, Sterlet, Whitefish, Dace, Roach, Bream.

Regulation of flow of the Oka River in connection with construction of the Bratsk Reservoir (Irkutsk Oblast) in Eastern Siberia has changed the proportions of fish species in the river as well as their distribution and migration. Prior to regulation, the species composition in the river was dace, salmon, and sterlet, and after regulation in 1963, pike. In 1964 the fishery of the river consisted of perch-pike; in 1965 it was perch-roach, and in 1966, roach-perch. The 4-year fish catch for 1963-66 was about 600, 800, 1,200 and 1,500 cntrs, respectively. Young species of whitefish and dace are found mainly in reservoir pools; older species inhabit upper reaches of the reservoir and the river. The bulk of fish catches in the area since 1963 has consisted of species spawned in the reservoir. (See also W72-04853) (Josefson-USGS)
W72-04858

LONG-TERM WATER-QUALITY CHARACTERISTICS OF THE BRATSK RESERVOIR AND FORECAST OF ORGANIC MATTER ACCUMULATION (MNOGOLETNYAYA KHARAKTERISTIKA FORMIROVANIYA KACHESTVA VODY I PROGNOZ NAKOPLENIYA ORGANICHESKOGO VESHCHESTVA V BRATSKOM VODOKHRANILISHCHE),
Vsesoyuznyi Nauchno-Issledovatelskii Institut Vodosnabzheniya, Kanalizatskii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
For primary bibliographic entry see Field 05C.
W72-04859

WATER QUALITY OF THE BRATSK RESERVOIR DURING THE FIRST YEARS OF IMPOUNDMENT, 1962-64 (SANITARNOYE SOSTOYANIYE BRATSKOGO VODOKHRANILISHCHA V PERVYYE GODY YEGO ZAPOLNENIYA (1962-1964 GG.)),
Nauchno-Issledovatelskii Institut Gigieny, Moscow (USSR).
For primary bibliographic entry see Field 05C.
W72-04860

ECOLOGY OF HETEROTROPHIC AEROBIC BACTERIA OF PLAYA LAKES AND MICROCOSMS,
Southern Colorado State Coll., Pueblo.
For primary bibliographic entry see Field 05C.
W72-04905

SEASONAL CALORIFIC VALUES OF FRESHWATER ZOOPLANKTON, AS DETERMINED WITH A PHILLIPSON BOMB CALORIMETER MODIFIED FOR SMALL SAMPLES,
Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
D. W. Schindler, A. C. Clark, and J. R. Gray.
J Fish Res Bd Can. 28 (4): 559-564. 1971. Illus.
Identifiers: Bomb, Calorific, Calorimeter, Cladocerans, Determined, Fresh, Phillipson, Plankton, Rotifers, Samples, Seasonal, Small.

A modified temperature sensing circuit for the Phillipson microbomb calorimeter allowed accurate calorific determinations on samples as small as 3 cal. Calorific values of copepods from 3 lakes in eastern Ontario varied with species, developmental stage, lake, season, and year. No such differences were observed in calorific values for the few species of rotifers and cladocerans tested. Similar calorific values were obtained for samples preserved by freezing, freeze-drying, and heat-drying, but preservation in formalin resulted in erroneously low calorific values.--Copyright 1971, Biological Abstracts, Inc.
W72-04912

INTRASPECIFIC VARIATIONS AND POST-GLACIAL DISTRIBUTION OF LAKE CHAR (SALVELINUS NAMAYCUSH),
Ottawa Univ. (Ontario). Dept. of Biology.
N. Y. Khan, and S. U. Qadri.
J Fish Res Bd Can. 28 (4): 465-476. 1971. Illus.
Identifiers: Char, Distribution, Gene, Glacial, Intraspecific, Lake, Pools, Post, Salvelinus-Namaycush, Variations.

A morphometric and meristic study of 325 S. namaycush from over its range of distribution showed different gene pools. The similarities and differences observed among lake char of various primary ocean drainages and among various populations of lake char within these drainages suggested that the species survived the last glaciation in unglaciated Alaska and Yukon, possibly other unglaciated northern areas, and at least 3 refugia in the south, the Atlantic, Upper Mississippi, and Upper Missouri.--Copyright 1971, Biological Abstracts, Inc.
W72-04913

LIMNOLOGICAL STUDIES OF THE LAKES AND STREAMS OF THE UPPER QU,APPELLE RIVER SYSTEM, SASKATCHEWAN, CANADA: I. CHEMICAL AND PHYSICAL ASPECTS OF THE LAKES AND DRAINAGE SYSTEM,
Univ. Saskatchewan, Saskatoon, Sask., Can. Biol. Dep.
For primary bibliographic entry see Field 05C.
W72-04975

PRIMARY PRODUCTION IN A TROPICAL FISH POND AT ALIGARH, INDIA,
Aligarh Muslim Univ. (India). Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W72-05000

ORGANIC CARBON AND NITROGEN IN THE SURFACE SEDIMENTS OF LAKES ONTARIO, ERIE AND HURON,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland Waters.
A. L. W. Kemp.
J Sediment Petrology. 41 (2): 537-548. 1971. Illus.
Identifiers: Bottom, Canada, Carbon, Erie, Huron, Lakes, Nitrogen, Ontario, Organic, Organisms, Sediments, Surface.

Analyses of 355 surface sediment samples (top cm) from Lakes Ontario, Erie and Huron were carried out for organic C, carbonate C, Eh, pH, N and sediment texture. Similar analyses were carried out on a representative core from each lake at close intervals down to 20 cm. The distribution of organic matter in the sediments of each lake was related to the topographic features of the lakes. Organic carbon content was found to be directly proportional to the clay content of the sediment, ranging from less than 1% in the coarse nearshore sands to over 4% in the fine clay muds within the individual lake sub-basins. The organic C content of Lake Erie sediments was generally lower than that of Lakes Huron and Ontario, and is attributed to dilution of the sediments with coarser non-clay particles. Nitrogen was directly proportional to organic C with C-N ratios ranging from 7 to 13 in the surface sediment. Organic C and N decreased sharply from the surface down to about 10 cm in each core. The decrease is due partly to mineralization of organic matter by bottom organisms and partly to an increasing input of organic matter to the lakes in the last 30 yr.--Copyright 1971, Biological Abstracts, Inc.
W72-05003

WATER, NITROGEN AND PHOSPHORUS IN FRESHWATER PLANKTON,
Aligarh Muslim Univ. (India). Dept. of Zoology.
For primary bibliographic entry see Field 05C.
W72-05009

THE RATE OF NUTRIENT RELEASE FROM GRASS AND DUNG FOLLOWING IMMERSION IN LAKE WATER,
Chancellor Coll., Limbe (Malawi).
S. M. Mc Lachlan.
Hydrobiologia. 37 (3/4): 521-530. 1971. Illus. French summary.
Identifiers: Buffalo, Dung, Elephant, Eragrostris-M, Grass-M, Immersion, Impala, Lake, Nutrient, Rate.

Two experiments were carried out to determine the rate of release of ions to lake water from dry grass (largely Eragrostis species) and dung from elephant, impala and buffalo. The ions released most rapidly were PO33- and K+, followed by NO3- and Ca2+ + Mg2+; the smallest increase was shown by Na+. In general, dung derived from grass released ions more rapidly than grass itself; the results are discussed in relation to ash analyses of grass and dung. The possible importance to Lake Kariba of the nutrients released by grass and dung following immersion under natural conditions is considered.--Copyright 1971, Biological Abstracts, Inc.
W72-05020

SHALLOW AQUATIC BIOTOPES AS LIMNOLOGICAL MODELS,
Hydrobiological Research Station, Madras (India).
For primary bibliographic entry see Field 05C.
W72-05023

PHOTOSYNTHETIC PROPERTIES AND GROWTH OF PHOTOSYNTHETIC SULFUR BACTERIA IN LAKES,
Fisheries Research Board of Canada, Nanaimo (British Columbia). Biological Station.
For primary bibliographic entry see Field 05C.
W72-05085

PRELIMINARY STUDIES ON THE COMPOSITION OF MAJOR IONS OF SOME FISH PONDS OF MALACCA IN MALAYSIA,
Kempas Devon Estate, Malacca (Malaysia).
Y. T. Tan.
Hydrobiologia. 37 (3/4): 537-543. 1971. Illus.
Identifiers: Composition, Fish, Ions, Malacca, Malaysia, Minerals, Ponds, Stock.

The ionic composition of tropical pond waters is discussed especially the major cations Ca (6.58 ppm) and Na (3.79 ppm) and the anions bicarbonate (20.24 ppm) and sulfate (21.69 ppm). Some ponds have extremely low alkalinity (10 to 27 ppm) and most of the ponds have poor dissolved Ca content (2.5 to 9.9 ppm). Their pHs lie between 6.71 to 7.70 except the control pond which had a pH of 5.21. The chemical data show differences in the ionic composition between the various ponds of different sizes. The differences can be due to the accumulated organic matter, types of fish stocked and the supplementary feeds used in the ponds.--Copyright 1971, Biological Abstracts, Inc.
W72-05107

DENITRIFICATION AS A NITROGEN SINK IN LAKE MENDOTA, WISCONSIN,
Wisconsin Univ., Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 05B.
W72-05130

THE ROLE OF LIGHT IN THE DISTRIBUTION OF EPIBIONTIC CHIRONOMID LARVAE IN LAKE SEVAN, (IN RUSSIAN),
V. P. Luferov.
Biol Vnutr Vod Inform Byull. 3. 23-27. 1969.
Identifiers: Chironomid, Distribution, Epibiontic, Lake, Larvae, Light, Orthocladius-Saxicola, Sevan, Tanytarsus-Sevanicus, USSR.

This material was collected in July 1964 at the entrance to the Artanysh Inlet at depths down to 20 m. Among the lithophilic epibionts the ones present in the greatest numbers were larvae of Tanytarsus sevanicus and Orthocladius ex gr. saxicola. For T. sevanicus the most photophilic proved to be larvae of the 1st instar, 92% of which were concentrated at a depth of 2 m with an illumination of 75,000 lux. Those of the 2nd and 3rd instars were concentrated at greater depths, down to 12-15 m with an illumination of 35,000-15,000 lux. Larvae of the 4th instar were found at a depth of 0.1-0.5 m with an illumination of 100,000-105,000 lux. Second-and 3rd-instar larvae were also concentrated at shallow depths with an illumination of about 95,000 lux. Fourth-instar larvae were found at a depth of 1-12 m with illumination of 90,000 to 25,000 lux. A similar picture of the distribution of representatives of the genera studied was also noted in Karelian lakes and the Volga reservoirs.--Copyright 1971, Biological Abstracts, Inc.
W72-05157

DISTRIBUTION OF HETEROTROPHIC BACTERIA AND THEIR POSSIBLE ROLE IN THE MINERALIZATION OF ORGANIC MATTER IN YUNO-KO, A MESOTROPHIC LAKE,
Tokyo Metropolitan Univ. (Japan).
For primary bibliographic entry see Field 05C.
W72-05160

ECOLOGICAL OBSERVATIONS ON THE ALTERATIONS IN THE LAKE BIOCENOSIS OF TOVEL LAKE (TRENTINO), (IN ITALIAN),
For primary bibliographic entry see Field 05C.
W72-05165

SOME CRUSTACEAN ZOOPLANKTON OF THE NOATAK RIVER AREA, NORTHERN ALASKA,
Arizona Univ., Tucson.
Jerry C. Tash.
Arctic 24 (2): 108-112. 1971.
Identifiers: Alaska, Cladocera, Copepoda, Crustacean, Noatak, Northern, Plankton, River.

Twenty-six spp. of Cladocera and 13 spp. of Copepoda were collected from lakes and pools in the Noatak river area of Northern Alaska. The lakes had an average of 14.50 spp. per lake and the pools 8.12 spp. per pool. Nine spp. were restricted to lakes and 13 to pools. Nineteen spp. occurred in both lakes and pools.--Copyright 1971, Biological Abstracts, Inc.
W72-05166

AGE AND LENGTH-WEIGHT COMPOSITION OF A MUD LAKE CARP SAMPLE,
Brighman Young Univ., Provo, Utah.
Dwight G. Smith, and David A. White.
Proc Utah Acad Sci Arts Lett. 46 (2): 106-108. 1969. Illus.
Identifiers: Age, Carp, Composition, Condition, Factor, Lake, Length, Mud, Sample, Weight.

A sample of carp collected from Aug. through Oct. 1968 was analyzed to determine age composition and length-weight relationships. The carp were found to vary from 1 to 6 yr old with age groups II and III dominating. Their average group lengths ranged from 266 mm to 483 mm, and the largest carp sampled had a length of 501 mm. The average weight of the sampled carp was 1647 g. and their K factor averaged 2.28. Comparisons with similar data from carp populations of four northern Utah carp habitats indicated that Mud Lake carp have a longer median length but a lower average weight and condition factor.--Copyright 1971, Biological Abstracts, Inc.
W72-05173

MODELLING OF POPULATIONS AND COMMUNITIES OF AQUATIC ANIMALS ON DIGITAL COMPUTERS (IN RUSSIAN),
Akademiya Nauk SSSR, Leningrad. Institut Evolyutsionnoi Fiziologii i Biokhimii.
V. V. Menshutkin.
Zool Zh. 50 (4): 461-473. Illus. 1971. English summary.
Identifiers: Animals, Aquatic, Communities, Computers, Crustaceans, Digital, Fish, Interpretations, Mathematical, Modelling, Molluscs, Populations.

The mathematical interpretation of basic concepts of ecology of populations and communities of aquatic animals is indispensable for modelling of these objects on computers. The theories of sets and graphs were used for such an interpretation. The elaborated method of modelling was tested on 16 models of populations of fishes, molluscs, and planktonic crustaceans, as well as on communities of the Dal'neye and Razdel'noye Lakes. The results of studying the models have shown the efficiency and prospects of using computers in the ecology of aquatic animals.--Copyright 1971, Biological Abstracts, Inc.
W72-05175

ECOLOGICAL CONSIDERATIONS OF THE ANIMAL POPULATION OF THE LAGABRUN PEAT-BOG,
Padua Univ. (Italy). Istituto di Biologia Anim.
Giorgio Marcuzzi, and Anna Maria Lorenzoni.

Stud Trentini Sci Nat Sez B Biol. 46 (2): 247-266. 1969. Illus.
Identifiers: Animal, Bog, Ceratopogonidae, Chironomidae, Density, Ecological, Gastropoda, Italy, Lagabrun, Nematodes, Oligochaeta, Peat, Population, Tardigrada.

A survey of animal life in a peat-bog area is presented. The represented population includes: Nematodes, Tardigrada, Oligochaeta, Ceratopogonidae, Chiromomidae and Gastropoda. The interrelationships among the animals and the density of each is discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-05181

GLACIAL LAKE PASSAIC: PALYNOLOGICAL EVIDENCE FOR DRAINING OF THE GREAT SWAMP STAGE,
Newark State Coll., Union, N.J.
A. Lee Meyerson.
Bull N J Acad Sci. 15 (1/2): 10-12. 1970. Illus. Map.
Identifiers: Draining, Glacial, Gramineae-M, Lake, New Jersey, Palynological, Passaic, Swamp.

A core, taken from the Great Swamp which was one of several lakes remaining after the draining of Lake Passaic, shows that the pollen spectra, found throughout the northeastern USA, are duplicated in the study area. An anomalous occurrence of Gramineae within the C1 zone represents the draining of the Great Swamp stage of Lake Passaic.--Copyright 1971, Biological Abstract, Inc.
W72-05200

ECOLOGICAL CONSIDERATIONS OF THE ANIMAL POPULATION OF THE SANTO LAKE OF CEMBRA,
Padua Univ. (Italy). Istituto di Biologia Anim.
Giorgio Marcuzzi, and Anna Maria Lorenzoni.
Stud Trentini Sci Nat Sez B Biol. 47 (1): 81-90. 1970.
Identifiers: Algae, Animal, Cembra, Ceratopogonidae, Chironomidae, Ecological, Italy, Krenopelopia-Binotata, Lake, Nematodes, Population, Santo, Tardigrada.

Previous studies on the animal population of the Santo Lake in Trentino are concluded. The data illustrate a fauna-ecological picture of a lacustrial environment of a middle mountainous area. Collaborative work on nematodes, Tardigrada, Ceratopogonidae, Chironomidae and algae is presented. Krenopelopia binotata appears to be a fairly typical specimen of the environment.--Copyright 1971, Biological Abstracts, Inc.
W72-05205

AN ANALYSIS OF THE FAUNA OF HUMIC LAKES WITH RESPECT TO THEIR TYPOLOGY, (IN RUSSIAN),
Gosudarstvennyi Nauchno-Issledvatelskii Institut Ozernogo i Rechnogo Rybnogo Khozyaistva, Leningrad (USSR).
For primary bibliographic entry see Field 05C.
W72-05206

IANULA: AN ACCOUNT OF THE HISTORY AND DEVELOPMENT OF THE LAGO DI MONTEROSI, LATIUM, ITALY: VIII. THE FOSSIL FLORA AND FAUNA (OTHER THAN SILICEOUS FOSSILS, POLLEN, AND CHIRONOMID HEAD CAPSULES),
Academy of Natural Sciences of Philadelphia, Pa.
For primary bibliographic entry see Field 05C.
W72-05207

IANULA: AN ACCOUNT OF THE HISTORY AND DEVELOPMENT OF THE LAGO DI MONTEROSI, LATIUM, ITALY: IV. PRESENT ECOLOGICAL CONDITIONS IN THE LAKE,
Instituto di Zoologia. Rome Univ. (Italy).
For primary bibliographic entry see Field 05C.
W72-05208

IANULA: AN ACCOUNT OF THE HISTORY AND DEVELOPMENT OF THE LAGO DI MONTEROSI, LATIUM, ITALY: XIII. THE HISTORY OF THE LAKE: A SYNTHESIS,
Yale Univ., New Haven, Conn. Dept. of Biology.
For primary bibliographic entry see Field 05C.
W72-05209

LIMNOLOGICAL STUDIES IN BELGIUM: VII. TWO PONDS AT NOTMEIR (ANVERS PROVINCE). A. ENVIRONMENTAL STUDY,
Institut Royal des Sciences Naturelles de Belgique, Brussels.
For primary bibliographic entry see Field 05C.
W72-05214

LIMNOLOGICAL STUDIES IN BELGIUM: VII. TWO PONDS AT NOTMEIR (ANVERS PROVINCE): B. PHYTOPLANKTONIC CONSIDERATIONS. C. CONCLUSIONS,
Institut Royal des Sciences Naturelles de Belgique, Brussels.
For primary bibliographic entry see Field 05C.
W72-05215

CHARACTERISTICS OF THE EPIDEMIOLOGY OF DIPHYLLOBOTHRIASIS IN SOME LAKE AREAS IN BURYATIA, (IN RUSSIAN),
Institute of Medical Parasitology and Tropical Medicine, Moscow (USSR).
For primary bibliographic entry see Field 05C.
W72-05225

AGE, GROWTH AND CONDITION OF BLACK CRAPPIE, POMOXIS NIGROMACULATUS (LE SUEUR), IN LEWIS AND CLARK LAKE, SOUTH DAKOTA, 1954 TO 1967,
Ghana Fish Dept., Akosombo.
C. J. Vanderpuye, and K. D. Carlander.
Iowa State J Sci. 45 (4): 541-555. 1971. Illus.
Identifiers: Age, Black, Clark, Condition, Crappie, Growth, Lake, Lewis, Pomoxis-Nigromaculatus, South-Dakota.

An abundant year class of black crappies developed in 1956, the year after Lewis and Clark Lake was impounded. No difference in growth rate of male and female crappies was noted. Growth was slow compared with most other waters and was slower the 1st few years than the 8 to 10 yr after impoundment. No differences were detected in length-weight relationships between samples collected in different areas of the lake nor between sexes. The slope of the length-weight relationship was more often above 3 than below. Slopes were below 3 in each June sample, probably because of loss of weight in spawning by the larger individuals. The slopes did not increase in July and Aug. in 1960, 1961 and 1967 as they did in the other years. Average condition factors were lower in 1957, 1959, and 1960.--Copyright 1971, Biological Abstracts, Inc.
W72-05264

ACCLIMATIZATION OF THE ISRAELI CARP IN LAKE DOJRAN (MACEDONIA), YUGOSLAVIA,
Zavod za Ribarstvo, Skoplje (Yugoslavia).
K. Apostolski.
Bamidgeh. 23 (1): 3-10. 1971. Illus.
Identifiers: Acclimatization, Carp, Dojran, Israeli, Lake, Macedonia, Nursery, Ponds, Yugoslavia.

During 1958-1962, the carp yield of Lake Dojran showed a continual decline. To raise the carp yield and vary the fish population, it was decided in 1961 to initiate planned stocking of the lake. For this purpose spawning and nursery ponds were constructed near the lake. In the 1st year the local carp was stocked in the lake, but gave disappointing results. After consultation with various institutes and the Fish Disease Laboratory at Nir-David (Israel), 12-yr-old breeder carps were brought from Israel in 1964. Since 1965 the lake has been successfully stocked with the Israeli carp.--Copyright 1971, Biological Abstracts, Inc.
W72-05267

2I. Water in Plants

THE FOOD OF THE GRAYLING THYMALLUS THYMALLUS (L.) OF THE RIVER LUGG., HEREFORDSHIRE,
Freshwater Biological Association, Wareham (England). River Lab.
J. M. Hellawell.
J Fish Biol. 3 (2): 187-197. 1971. Illus.
Identifiers: Crustacea, Eggs, England, Food, Grayling, Herefordshire, Insect, Larvae, Lugg, Mollusks, River, Stomach, Thymallus-Thymallus.

The examination of the stomach contents of 253 grayling from the River Lugg has provided some evidence of a possible depression of feeding activity during the summer months. The diet was varied but bottom food predominated, especially insect larvae, Crustacea and molluscs. Some surface foods were taken but plant material was rarely eaten. Substrate material, detritus and debris and even large pebbles were eaten, mainly in summer. Most seasonal variations in diet could be related to variations in availability. Fish were not eaten but cyprinid and salmonid eggs were eaten at the appropriate season. In general, increasing amounts of larger food items were eaten by the older grayling.--Copyright 1971, Biological Abstracts, Inc.
W72-04712

CONTRIBUTION OF YOUNG FISH TO TOTAL PRODUCTION OF FISH IN THE RIVER THAMES NEAR READING,
Food and Agriculture Organization of the United Nations, Mexico City.
C. P. Mathews.
J Fish Biol. 3 (2): 157-180. 1971. Illus.
Identifiers: Biomass, England, Fish, Mortality, Production, Reading, River, Thames, Young.

The production of the young stages of four species of cyprinid fish in the River Thames was estimated. From the time when underyearling fish became fully vulnerable to the special fine mesh net used, to the end of their 1st yr, production is 39 g/sq m/year compared with 83.3 g /sq m/year for fish over 1-yr old. The contribution of fecundity to population production varied widely, from 6.1 to 0.4 g/sq m/year, but was only a small part of total production. The most productive part of the population was that found between spawning and prior to full vulnerability to the net. Production of this part of the population could be estimated only indirectly and was found to be 58.6 g/sq m/year. In the 4 populations studied production during the 1st yr of life was 66 to 73% of total cohort production in 1967 and only 39 to 64% in 1968. Total fish production in the Thames was estimated at 197 k cal/sq m/year; this high result is a consequence of the very high densities found: up to 96.9 fish/sq m were present in Aug. 1967. Ten km of the Thames would contain about 54 million fish in Aug., falling to around 8 million in winter. The production:biomass ratios for the 4 spp. varied from 1.1 to 1.9 in 1967 and from 0.7 to 2.0 in 1968. Very heavy, possibly density dependent, mortality occurs in the 1st yr of life; the annual instantaneous mortality rates are very high, ranging from 6.4 to 8.7. Mortality is heaviest during the 1st 2 to 3 mo. after spawning; the instantaneous mortality rates during this period vary from 4.0 to 7.3.--Copyright 1971, Biological Abstracts, Inc.
W72-04721

INTRASEASONAL CHANGES IN CALORIC CONTENT OF SOME FRESHWATER INVERTEBRATES,
Miami Univ., Oxford, Ohio. Dept. of Zoology; and Miami Univ., Oxford, Ohio. Dept. of Physiology.
Thomas E. Wissing, and Arthur D. Hasler.
Ecology. 52 (2): 371-373. 1971.
Identifiers: Caloric, Daphnia, Fish, Fresh, Glyptotendipes-Sp, Hyalella-Azteca, Intra, Invertebrates, Leptodora-Kindtii, Predators, Seasonal.

Intraseasonal changes in caloric contents of planktonic cladocerans (Daphnia spp. and Leptodora kindtii), amphipods (Hyalella azteca), and chironomid larvae (primarily Glyptotendipes sp.) were studied in 1968. Mid-summer decreases 823, 2117, and 422 g-cal/g dry weight were observed in the Daphnia. L. kindtii. and H. azteca, respectively. Caloric content of Daphnia increased again during Aug. and early Sept. The energy content of chironomid larvae increased steadily during June and July and then declined. The low value (4899 g-cal/g dry weight) occurred on 9 Sept. Variation in energy content of the Daphnia appeared to be related to known changes in population numbers. The influence of significant changes in caloric contents of food organisms on the daily ration of predator fish species is discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-04722

SOME ASPECTS OF BIOLOGY OF THE LONGFIN DACE, A CYPRINID FISH CHARACTERISTIC OF STREAMS IN THE SONORAN DESERT,
Arizona State Univ., Tempe. Dept. of Zoology.
W. L. Minckley, and Willard E. Barber.
Southwest Natur. 15 (4): 459-464. 1971.
Identifiers: Behavior, Biology, Characteristic, Cyprinid, Dace, Desert, Fish, Longfin, Sonoran, Spawning, Streams.

The longfin dace spawns over a prolonged period, Dec. through July, in low-desert streams, utilizing saucer-shaped depressions in sandy-bottomed, shallow pools. No territoriality is evident. Females enter a nest area to be serviced by one or more males in a 'chase and flurry' type of spawning behavior. The species is highly opportunistic, dispersing rapidly to newly flooded stream segments in periods of high runoff. It is capable of persisting for an amazing period of time in desiccating streams through various behavioral means.--Copyright 1971, Biological Abstracts, Inc.
W72-04723

REARING THE BAY SCALLOP, AEQUIPECTEN IRRADIANS,
Virginia Inst. of Marine Science, Wachapreague.
Michael Castagna, and William Duggan.
Proc Nat Shellfish Ass. 61: 80-85. 1971. Illus.
Identifiers: Aequipecten-Irradians, Algae, Bay, Food, Rearing, Scallop, Stimulus, Thermal.

A irradians, collected from various bays along the Eastern Shore of Virginia and from Bogue Sound, North Carolina, were conditioned and spawned in the laboratory, out of their normal sprawning period. A thermal stimulus of 21-27 deg C was used to stimulate spawning, and larvae set in 10-19 days using cultured algae as food. Juvenile scallops were held in plastic trays in the laboratory for 1 wk, then moved to outdoor tanks with flowing, unfiltered seawater. They remained there until they were about 2 mm in width, then moved to plastic screened wooden floats in the field where they reached an average minimum market size (50 mm) in 12-13 mo. Mortality of larvae, early postset scallops and adults is described. The bay scallop appears to be amenable to mariculture. The biological feasibility of rearing bay scallops from egg to market size has been established.--Copyright 1971, Biological Abstracts, Inc.
W72-04724

THE OYSTER PRODUCING POTENTIAL OF PUGET SOUND,
Shellfish Lab., Brinnon, Wash.
Ronald E. Westley.
Proc Nat Shellfish Ass. 61: 20-23. 1971. Maps.
Identifiers: Floating, Japan, Method, Oyster, Potential, Producing, Puget, Sound, Washington.

An evaluation of the oyster producing potential of Puget Sound reveals that a sustained annual production of up to 6 billion lb. of meat may be possible. Production at this level is based upon using the methods of floating culture developed in Japan in combination with the tremendous fertility and food producing ability of Puget Sound.--Copyright 1971, Biological Abstracts, Inc.
W72-04725

THE ABERNATHY SALMON DIET,
Bureau of Sport Fisheries and Wildlife, Longview, Wash. Salmon-Cultural Lab.
Laurie G. Fowler, and Roger E. Burrows.
Progr Fish-Cult. 33 (2): 67-75. 1971.
Identifiers: Abernathy, Diet, Fish, Meal, Oncorhynchus, Salmon, Vitamin.

An open formula dry diet has been developed for salmon (Oncorhynchus). The diet can be made in different particle sizes ranging from a starter granule for 1st feeding fish to extruded pellets for larger fish. It is a simplified diet containing fish meal, dried whey product, cottonseed meal, wheat germ meal, a vitamin supplement, and soybean oil, and has proved to be both nutritionally adequate and economically feasible.--Copyright 1971, Biological Abstracts, Inc.
W72-04728

PERCENTAGE OF SOLIDS AND LENGTH--WEIGHT RELATIONSHIP OF THE OCEAN QUAHOG,
National Marine Fisheries Service, Oxford, Md. Biological Lab.
John W. Ropes.
Proc Nat Shellfish Ass. 61: 88-90. Illus. 1971.
Identifiers: Arctica-islandica, Length, Ocean, Quahog, Relationship, Solids, Weight.

Percentage of solids of ocean quahogs, Arctica islandica, were determined for samples taken from offshore Long Island, New York. Solids averaged 18.5% for clams between 30 and 129 mm in shell length. Dry meat weights increased most rapidly between clam lengths of 92-113 mm. Calculated yields of bushel quantities are given for 2 areas off Long Island and New Jersey where clams are plentiful.--Copyright 1971, Biological Abstracts, Inc.
W72-04744

A HYPOTHESIS OF ALTERNATION OF AGE OF RETURN IN SUCCESSIVE GENERATIONS OF SKEENA RIVER SOCKEYE SALMON (ONCORHYNCHUS NERKA),
Fisheries Research Board of Canada, Nanaimo (British Columbia). Biological Station.
H. T. Bilton.
J Fish Res Bd Can. 28 (4): 513-516. 1971.
Identifiers: Age, Alternation, Egg, Examination, Generations, Hypothesis, Oncorhynchus-nerka, River, Salmon, Scale, Skeena, Sockeye, Successive, Weight.

Egg weight of Scully Creek and Lower Babine River O. nerka was positively correlated with length and, usually, age of the female parent. Egg weight was positively correlated with initial size and subsequent growth of juveniles, at least up to 3 mo. of age. Examination of scales indicated juvenile growth in the lake and ocean was inversely related to age at maturity. Hence it was hypothesized that the larger age 1.3 sockeye spawners tend to produce progeny that mature as smaller age 1.2 fish, which in turn give rise to progeny that mature as larger age 1.3 fish, and so on; an alternation in age of return of successive generations occurs.--Copyright 1971, Biological Abstracts, Inc.
W72-04755

PIGMENTATION OF BROOK TROUT (SALVELINUS FONTINALIS) BY FEEDING DRIED CRUSTACEAN WASTE,
Fisheries Research Board of Canada, Halifax (Nova Scotia). Halifax Lab.
Akira Saito, and L. W. Regier.
J Fish Res Bd Can. 28 (4): 509-512. 1971.
Identifiers: Brook, Crustacean, Dried, Feeding, Fishery, Pigmentation, Salvelinus-Fontinalis, Trout, Waste.

Shrimp and crab wastes were fed to yearling brook trout for 12 wk. Diets containing 20 and 30% shrimp waste, 20% crab waste, and 0.004% canthaxanthin were compared with a commercial trout diet. The carotenoid contents of the flesh and skin were highest with the canthaxanthin-fed fish, but the 20% shrimp-waste-fed fish had the most desirable color visually within the feeding period used.--Copyright 1971, Biological Abstracts, Inc.
W72-04756

LICHEN POPULATIONS ON ARID SOIL CRUSTS AROUND SHEEP WATERING PLACES IN SOUTH AUSTRALIA,
Adelaide Univ. (Australia). Dept. of Botany.
R. W. Rogers, and R. T. Lange.
Oikos. 22 (1): 93-100. 1971. Illus. Maps. Russian summary.
Identifiers: Arid, Australia, Crusts, Lichen, Places, Populations, Pressure, Sheep, Soil, South, Stocking, Watering.

Lichen populations, which encrust and stabilize soil surfaces in much of arid Australia, were studied around sheep watering places in 2 large paddocks near Whyalla, South Australia. In quadrat studies 24 taxa occurred on the soil surface. Frequency data for many species reflected the relative intensity of stocking pressure at different distances from the watering place. Influence analysis, a technique derived from association analysis, showed that many significant interactions existed in the distribution of species in the quadrats. The spatial distribution of the interacting species showed that many of them were influenced in similar ways by stocking pressure and watercourse conditions. Others, while effected by stocking pressure, were not influenced by watercourse conditions. Stocking pressure caused differential destruction of species populations near the watering places. Unlike the higher vegetation, the soil crust lichen vegetation has no species which are stimulated to greater population development by intense stocking pressure. On destruction of the original lichen crust the soil surface is left bare.--Copyright 1971, Biological Abstract, Inc.
W72-04790

PROXIMATE COMPOSITION OF FRESHWATER FISH GRASS CARP, PUNTIUS GONIONOTUS AND TILAPIA,
Fish Culture Research Training Inst., Malacca (Malaysia).
Y. T. Tan.
Hydrobiologia. 37 (2): 361-366. 1971.
Identifiers: Carp, Composition, Ctenopharyngodon-Idellus, Diet, Fat, Fish, Grass, Hydrilla-Verticillata-M, Manihot-Utilissimus-D, Minerals, Pennisetum-Purpureum-M, Protein, Proximate, Puntius-Gonionotus, Tilapia.

The proximate analyses of freshwater fish - grass carp (Ctenopharyngodon idellus), P. gonionotus and Tilapia (male hybrid) are compared. Dried meals from eviscerated freshwater fish contained 57.36-75.92% protein; 4.48-31.84% fat and 10.68-22.88% ash. The results indicate that Tilapia had a higher fat content than gonionotus and grass carp, the latter having the lowest fat content. The reverse is true for protein, ash and minerals like Na, P and K. The composition of grass carp feeding on different diets, such as Hydrilla verticillata, Napier grass (Pennisetum purpureum) and tapioca leaves (Manihot utilissins) indicated only a slight difference in protein content but a significant difference in fat and ash. The tabulated results show that grass carp and gonionotus were of higher nutritive value when compared to the Tilapia.--Copyright 1971, Biological Abstracts, Inc.
W72-05102

THE EFFECT OF WIND ON STOMATAL APERTURE, PHOTOSYNTHESIS, AND TRANSPIRATION OF RHODODENDRON FERRUGINEUM L. AND PINUS CEMBRA L.,
Utah State Univ., Logan. Dept. of Range Science.
Martyn M. Caldwell.

Centralbl Gesamte Forstw. 87 (4): 193-201. 1970. Illus. German summary.
Identifiers: Aperture, Climatized, Exchange, Gas, Photosynthesis, Pinus-Cembra-G, Rhododendron-Ferrugineum-D, Stomatal, Transpiration, Tunnels, Wind.

Seedlings of the 2 spp. were removed from their natural sites and placed in climatized wind tunnels. Infiltration porometer measurements of stomatal aperture showed that wind had little effect on the stomates of Pinus cembra seedlings which grow on wind-swept ridges. For the majority of individuals, exposure to wind induced partial closure only for stomates on the current year's flush of needles. Stomatal aperture determinations for Rhododendron ferrugineum, which grows in protected ravines, demonstrated a rapid and pronounced closure of all stomates at very low wind speeds. Gas exchange measurements indicated a small enhancement of transpiration for P. cembra at low wind speeds (up to 3.5 m sec-1). Photosynthesis was unaffected. At higher speeds (up to 8 m sec-1) both photosynthesis and transpiration were mildly suppressed. Rhododendron seedlings reacted to slight increases in wind speed with substantial reductions in photosynthesis and even greater attenuation of transpiration. The response of photosynthesis and transpiration to wind speed for these 2 species is discussed in respect to the diffusion resistances for plant gas exchange.--Copyright 1971, Biological Abstracts, Inc.
W72-05108

NATURAL HYBRIDIZATION AND REPRODUCTIVE ECOLOGY OF TWO TOAD SPECIES IN A DISTURBED ENVIRONMENT,
Illinois State Univ., Normal. Dept. of Biological Science.
Lauren E. Brown.
Amer Midland Natur. 86 (1): 78-85. 1971.
Identifiers: Bufo-Valliceps, Bufo-Woodhousei, Disturbed, Ecology, Environment, Heterosis, Hybridization, Natural, Reproductive, Species, Toad.

Studies on the reproductive ecology of Bufo valliceps, B. woodhousei and their natural hybrids were carried out at a fish hatchery in Austin, Texas. The structural arrangement of the ponds and heavy predation on the toads by fish hatchery personnel made the area a highly disturbed environment for breeding toads. Interspecific amplexed pairings made up 8.8% of the total number of pairs observed. Male hybrids were estimated as comprising 6.0% of the total number of adult calling males. Unusual regulation of the water supply to the ponds may have been a possible cause of the natural hybridization by affecting breeding seasons and breeding-site utilization. Spatial isolation did not appear to be completely effective. Size difference was not an isolating mechanism at the hatchery although size discrimination was evident in a B. valliceps population outside the hatchery. B. valliceps from the hatchery were much larger than those from the surrounding area. The hatchery hybrids did not show heterosis in regard to adult size although hybrids from Louisiana were heterotic in this character.--Copyright 1971, Biological Abstracts, Inc.
W72-05117

WATER STRESS GRADIENTS IN PLANTS AND SOIL-ROOT SYSTEMS,
Connecticut Agricultural Experiment Station, Windsor. Valley Lab.
For primary bibliographic entry see Field 02G.
W72-05139

A PHYSICAL ANALYSIS OF DIURNAL TEMPERATURE REGIMES IN CLEAR AND TURBID WATER LAYERS: A PROBLEM IN RICE CULTURE,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research and Regional Survey.
For primary bibliographic entry see Field 02D.
W72-05144

SOIL MOISTURE CONTENT, TILTH, AND SOYBEAN RESPONSE WITH SURFACE AND SUBSURFACE DRAINAGE,
Agricultural Research Service, Wooster, Ohio. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02G.
W72-05145

MOISTURE AS A FACTOR INFLUENCING THE DISTRIBUTION OF TWO SPECIES OF TERRESTRIAL SALAMANDERS,
Maryland Univ., College Park. Dept. of Zoology.
R. G. Jaeger.
Oecologia. 6 (3): 191-207. 1971. Illus.
Identifiers: Distribution, Factor, Moisture, Plethodon-Cinereus, Plethodon-Richmondi-Shenandoah, Salamanders, Species, Terrestrial.

Plethodon richmondi shenandoah occurs in at least three geographically isolated talus slopes in Shenandoah National Park, Virginia, each surrounded by a continuous population of Plethodon c. cinereus in the soil outside the talus. Distributions are contiguous but largely non-overlapping. The talus presents a much drier habitat than does the surrounding soil. Four experiments were designed to test the responses of the 2 species to moisture and substrate. Although shenandoah lives in a habitat generally drier than that of cinereus, both species choose the wet end of a moisture gradient and do not differ significantly in moisture preference. When given choices between a substrate of rock or soil, the 2 spp. respond similarly: neither expresses a preference when both substrates are moist and both choose soil over rock as the substrates dry, showing that substrate preference is based on moisture content and not texture. A 3rd experiment demonstrates that cinereus suffers significantly greater mortality and loss of body water when subjected to a soil substrate, since the latter holds moisture longer. Thus the talus most likely presents a greater stress of dehydration to salamanders than does the soil. A 4th experiment shows that when forced to dehydrate, shenandoah survives longer, loses significantly less body water per hour, and withstands a greater loss of body water before death than does cinereus. The conclusions drawn are that cinereus inhabits areas of deep soil not due to a preference for that substrate but due to the requirement of a moist substrate, and it cannot enter the talus due to the dry conditions there. P.r. shenandoah, neither prefers the rocky nor the dry conditions of the talus and is probably excluded from the soil by the presence of cinereus. The survival of shenandoah in the talus is due, at least in part, to its ability to withstand the stress of dehydration for a longer period than can cinereus.--Copyyright 1971, Biological Abstracts, Inc.
W72-05154

CARBON DIOXIDE EXCHANGE OF A TROPICAL RAIN FOREST: PART I,
Connecticut Agricultural Experiment Station, New Haven.
For primary bibliographic entry see Field 02B.
W72-05167

CARBON DIOXIDE EXCHANGE OF A TROPICAL RAIN FOREST: PART II,
Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 02B.
W72-05168

SOCIAL BEHAVIOUR AND PRODUCTION OF AYU-FISH IN THE RIVER UKAWA BETWEEN 1955 AND 1969, WITH REFERENCE TO THE STABILITY OF ITS TERRITORIALITY (IN JAPANESE),
Kyoto Univ. (Japan). Faculty of Science.
Hiroya Kawanabe.
Jap J Ecol. 20 (4): 144-151. 1970. Illus. English summary.
Identifiers: Algal, Ayu-Fish, Behavior, Mortality, Plecoglossus-Altivelis, Projection, River, Social, Stability, Territoriality, Ukawa.

The immigration number from the sea in spring, population density, body-length distribution and social behavior during the settling season (summer) of Ayu-fish (Plecoglossus altivelis) were investigated from 1955 to 1969 in the River Ukawa. The population density varied between 0.03 and 5.5 individuals/m2, but the natural mortality from spring to summer was stable at about a 1/2 to 1/4. Social behavior was changed by population density and growth was not limited directly by algal production but mediated by the social structure. When overall population density increased 4 times, territorial structure was established only in certain types of riverbed. Territorial structure of Ayu probably evolved as a self-regulatory process.--Copyright 1971, Biological Abstracts, Inc.
W72-05176

BIOLOGICAL OBSERVATIONS ON SARDINELLA AURITA: A. STOMACH CONTENTS (IN PORTUGUESE),
Instituto de Pesquisas da Marinha, Rio de Janeiro (Brazil).
Rudolf Barth.
Publ Inst Pesqui Mar. 043. 1-14. 1970. Illus. English summary.
Identifiers: Biological, Copepoda, Coscinodiscinae, Sardinella-Aurita, Stomach.

As shown by results of studies on its stomach content, pilchard feeds on total plankton by water filtration through its branchial apparatus. There was no indication that it could chose selected objects of plankton. Agreement between results of stomach content analysis and plankton studies in fishing areas is shown by the fact that composition differences for plankton in area A (area north of Cabo Frio) and in area B (area between Cabo Frio and Ilha Grande) are perfectly reproduced in studies of stomach contents. The great quantity of Coscinoidiscinae in area A is substituted in area B by great amounts of Copepoda, other Crustacea, and mainly larval forms. This compensation effect is perfect, as shown by the excellent coincidence of fat droplets counts in both areas.--Copyright 1971, Biological Abstracts, Inc.
W72-05193

STUDIES ON BOTTOM-LIVING DIATOMS OF A FRESHWATER FISH POND,
Central Inland Fisheries Research Inst., Cuttack (India). Fisheries Research Station.
C. S. Singh.
J Bombay Natur Hist Soc. 67 (3): 443-452. 1970. Illus.
Identifiers: Bottom, Diatoms, Fish, Pond.

Bottom-flora of ponds, dominated mainly by diatoms have a direct bearing on the production of bottom feeding fishes, since they form the food of these fishes directly, or indirectly through zooplankters which feed on the algae. They also serve as indicators of the soil and water conditions at the bottom of the water body. A preliminary taxonomic study of the soil diatom flora of Kolhapur was made by Gandhi (1956). In view of the scanty information available on the soil diatom flora of ponds in India, an attempt was made to study the diatom flora of a fish pond with special reference to their taxonomy and seasonal fluctuation in relation to certain chemical factors of bottom soil and water.--Copyright 1971, Biological Abstracts, Inc.
W72-05221

GERMINATION RESPONSES OF THREE DESERT GRASSES TO MOISTURE STRESS AND LIGHT,
Carlos R. Tapia, and Ervin M. Schmutz.
J Range Manage. 24 (4): 292-295. 1971. Illus.
Identifiers: Arizona, Bristle, Cottontop-M, Depth, Desert, Eragrostis-Lehmanniana-M, Germination,

Grass-M, Grasses-M, Lehmann, Light, Love, Moisture, Plains, Planting, Setaria-Macrostachya-M, Stress, Trichachne-Californica-M.

Lehmann lovegrass (Eragrostis lehmanniana) appeared very susceptible to physiological drought while Arizona cottontop (Trichachne californica) and plains bristlegrass (Setaria macrostachya) were not appreciably affected until osmotic tensions exceeded 12 atm. Lehmann lovegrass was the fastest and plains bristlegrass was the slowest to germinate. This study indicated that the adaptability and responsiveness of Lehmann lovegrass is due to its ability to germinate rapidly whereas the other 2 spp. require more time of moisture availability. Lehmann lovegrass and Arizona cottontop appeared adversely affected by constant darkness which suggests that they require a shallow planting while plains bristlegrass seemed to have the opposite response, which suggests that it requires a deeper planting.--Copyright 1971, Biological Abstracts, Inc.
W72-05222

THE EFFECT OF EPIDERMAL CELL WATER POTENTIAL ON STOMATAL RESPONSE TO ILLUMINATION OF LEAF DISCS OF VICIA FABA,
Tel-Aviv Univ. (Israel). Dept. of Botany.
Z. Glinka.
Physiol Plan. 24 (3): 476-479. 1971. Illus.
Identifiers: Cell, Cells, Discs, Epidermal, Guard, Illumination, Incipient, Leaf, Mannitol, Osmotic, Plasmolysis, Potential, Pressure, Stomatal, Turgor, Vicia-Faba-D.

Illuminated leaf discs of Vicia faba were brought into equilibrium with a series of mannitol solutions. The width of stomatal aperture and the osmotic potential of guard cells and epidermal cells were determined. The maximal aperture was obtained when epidermal cells were at about incipient plasmolysis and any increase in their turgor pressure brought about a decrease in stomatal aperture. These findings emphasize the importance of epidermal cells in determining the width of the stomatal pore.--Copyright 1971, Biological Abstracts, Inc.
W72-05240

RECOVERY OF PHOTOSYNTHESIS IN SUNFLOWER AFTER A PERIOD OF LOW LEAF WATER POTENTIAL,
Illinois Univ., Urbana. Dept. of Botany.
J. S. Boyer.
Plant Physiol. 47 (6): 816-820. 1971. Illus.
Identifiers: Desiccation, Leaf, Light, Low, Opening, Period, Photosynthesis, Potential, Recovery, Roots, Soil, Stem, Stomatal, Sunflower-D.

Photosynthesis was studied in sunflower plants subjected to 1-2 days of desiccation and then permitted to recover. The leaf water potential to which leaves returned after rewatering was dependent on the severity of desiccation and the evaporative conditions. Under moderately evaporative conditions, leaf water potential returned to predesiccation levels after 3-5 hr when desiccation was slight. Leaf water potentials remained below predesiccation levels for several days after rewatering when leaf water potentials decreased to -13 to -19 bars during desiccation. Leaf water potential showed no sign of recovery when leaf water potentials decreased to -20 bars or below during desiccation. The lack of full recovery of leaf water potential was attributable to increased resistance to water transport in the roots and stem. The resistance ultimately became large enough to result in death of the leaves because net water loss continued even after the soil had been rewatered. Measurements of photosynthesis were made at high light intensities, where stomatal aperture often affects photosynthesis, and at low light intensities, where the photochemical activity of the leaves limits photosynthesis. Providing leaf water potentials remained above -12 bars during the desiccation period and returned to predesiccation levels during recovery, photosynthesis under both low and high light paralleed the recovery in leaf water potential after rewatering. After desiccation to leaf water potentials below -12 bars, recovery was incomplete under high light and could be attributed to lack of full stomatal opening. Lack of full opening persisted for 3 days and showed no sign of eventual recovery even though leaf water potentials recovered fully. Under low light however, recovery in photochemical activity was complete within 15 hr after desiccation to leaf water potentials as low as -17 bars.--Copyright 1971, Biological Abstracts, Inc.
W72-05243

THE INFLUENCE OF SOIL MOISTURE ON APPLE ROOT GROWTH AND ROOT:SHOOT RATIOS,
J. E. L. Cripps.
J Hort Sci. 46 (2): 121-130. 1971.
Identifiers: Apple-D, Growth, Irrigation, Moisture, Ratios, Root, Shoot, Soil, Waterlogging.

Moisture stress, fluctuating soil moisture availability and waterlogging during the summer months all reduced growth and increased root:shoot ratios of young 'Granny Smith' apple trees on 'Malling Merton 115' rootstocks. Antitranspirants did not overcome the adverse effects of fluctuating soil moisture availability on shoot growth. Some reduction in root growth was also brought about by moisture stress, and since roots tended to proliferate less in dry soil, the general configuration of the root system was changed. Frequent irrigation which maintained the soil at field capacity produced the largest trees on MM. 115. Trees on seedling rootstocks were comparatively unaffected by moisture stress or by waterlogging.--Copyright 1971, Biological Abstracts, Inc.
W72-05246

ANNUAL CHANGES IN OSMOTIC CONDITIONS AND CARBOHYDRATE CONTENTS IN EAST-AFGHANISTAN TREES I. QUERCUS BALOUT GRIFFITH, (IN GERMAN),
Bonn Univ. (West Germany). Pharmakognostisches Institut.
S. W. Breckle.
Flora (Jena). 160 (1): 43-59. 1971. Illus. Map. (English summary).
Identifiers: Afghanistan, Annual, Carbohydrate, East, Glucose, Osmotic, Quercus-Balout-D, Raffinose, Sucrose, Trees.

The 2 study localities of Quercus balout located near the western limit of the distributional area in eastern Afghanistan, were climatically characterized. The locality near Charikar was within irrigated land. The other locality at the Latahbandpass is one of the last natural localities of this oak near Kabul. The annual curves of the potential osmotical pressure and of the refractive index of cell sap were highest during winter. Sucrose and glucose in leaves and bark showed distinct seasonal variations, which were similar to those of middle European species. The minimum starch and the maximum sugar content during winter were correlated with the occurrence of raffinose in leaves and bark. Near the western limit of the range the winter frost conditions seem to be more important than drought during summer.--Copyright 1971, Biological Abstracts, Inc.
W72-05260

INFLUENCE OF RATE OF FEEDING AND BODY WEIGHT ON PROTEIN METABOLISM OF BLUEGILL SUNFISH,
Arizona State Univ., Tempe. Dept. of Zoology.
Shelby D. Gerking.
Physiol Zooel. 44 (1): 9-19. 1971. Illus.
Identifiers: Apparatus, Bluegill, Body, Feeding, Kjeldahl, Lepomis-Macrochirus, Metabolism, Protein, Rate, Sunfish, Tenebrio-Molitor, Weight.

The research was directed at the general problem of fish production where growth is of primary concern. Growth of the bluegill sunfish (Lepomis macrochirus) of different sizes was determined by feeding larvae of Tenebrio molitor (mealworms) at various rates in laboratory aquaria. Growth was defined as protein accumulation, and an N balance method was used to partition the food intake into its various uses. A total of 59 specimens of weights averaging 13.9, 27.0, 41.3, 68.9, and 85.2 g were fed from 20 to 30 days in individual aquaria. Most of the fish were taken from 3 lakes in northern Indiana; one series was collected in the southern part of the state. With the exception of 1 series, the aquaria were kept in a temperature controlled room at 24.5 C with 12 hr of light. The mealworms, a group of sample fish at the beginning of the feeding period, and the experimental fish at the end of the period were analyzed for N content with the micro-Kjeldahl apparatus. Each of the 5 experiments yielded a linear relation between N retained and N consumed, expressed in milligrams of N per day. This relation held for fish fed above- and below-maintenance rations. A progressive reduction in the rate of N retention in relation to N consumption occurred as weight increased. An analysis of variance indicated that the regression coefficients differed significantly among themselves, implying an influence of size on the gross efficiency of protein utilization for growth. Size also influenced the partial (net) growth efficiency measured as protein. The amount of N required to maintain equilibrium under the conditions of the experiment was measured as the x-intercept of the regression. Maintenance N increased as weight increased, with 1 exception. The y-intercept--the point of endogenous N excretion--followed the same general trend as did the x-intercept. Variation in the rate of N retention for a given consumption rate was greater than desirable and was attributed to the inability of obtaining experimental animals from a constant source with the same nutritional history. The present results are compared in detail with those that have appeared in the literature.--Copyright 1971, Biological Abstracts, Inc.
W72-05262

GROWTH OF CHONDROSTOMA NASUS (LINNAEUS, 1758) IN DUNAJEC AND RABA OF THE UPPER VISTULA RIVER SYSTEM,
Karlova Universita, (Czechoslovakia). Lab. of Ichthylogy.
Karthigesu Chitravadivelu.
Vestn Cesk Spolecnosti Zool. 35 (2): 85-91. 1971. Illus.
Identifiers: Chondrostoma-Nasus, Czechoslovakia, Dunajec, Growth, Poland, Raba, River, System, Upper, Vistula.

The growth of C. nasus from the Dunajec river in the vicinity of Roznow and the Raba river (both tributaries of the Upper Vistula in Poland), was studied using scales from 81 specimens by the R. Lees method. The growth rate is almost the same up to the 3rd yr of life, and differs markedly during the later years of life, when growth in Dunajec is better. Compared with 15 localities in Czechoslovakia, growth in Dunajec is excelled only by that in Orave River Valley Reservoir. Growth of Chondrostoma in Dunajec-Roznow is also better than that in Dunajec in the vicinity of Lopuszna and the San-upper reaches of Poland, but lower than that in Vistula, Pulawy. Growth in Raba is higher than that in San-upper reaches only.--Copyright 1971, Biological Abstracts, Inc.
W72-05263

FLOODED MEADOW COMMUNITIES. AN ANALYSIS OF PRODUCTIVITY IN A DRY YEAR,
Ceskoslovenska Akademie Ved, Brno. Botanicka Ustav.
Jana Jakrlova.
Folia Geobot Phytotaxon. 6 (1): 1-27. 1971. Illus.
Identifiers: Carex-Praecox-M, Carex-Suzae-M, Communities, Dry, Festuca-M, Flooded, Galium-Boreale-D, Glyceria-M, Gratiola-Officinalis-D, Growth, Meadow, Productivity, Ratio, Root, Rorippa-Sylvestris-D, Serratula-D, Shoot, Year.

In 1967, a study was made of the production of the following 4 selected plant communities arranged in an ecological series according to moisture: Serratuleto-Festucetum commutatae, Gratiola officinalis-Carex praecox-suzae subass. Galium boreale, Gratiola officinalis-Carex praecox-suzae subass. Rorippa sylvestris; and Glycerietum maximae, the most humid member. The rate of aerial and root production, root:shoot ratio, weight ratio of various plant groups to the dominant, vertical structure of the vegetation, and ash content were determined. Primary dry matter production was used for determining the values of growth characteristics, i.e., relative growth rate and productivity.--Copyright 1971, Biological Abstracts, Inc.
W72-05265

STUDIES ON CARP NUTRITION: III. EXPERIMENTS ON THE AFFECT ON FISH YIELD OF DIETARY PROTEIN SOURCE AND CONCENTRATION,
Fish Culture Research Station, Dor (Israel).
B. Hepher, J. Chervinski, and H. Tagari.
Bamidgeh. 23 (1): 11-37. 1971.
Identifiers: Carp, Concentration, Dietary, Fish, Nutrition, Protein, Rate, Sorghum-M, Soy-D, Stocking, Wheat-M, Yield.

Carps were fed experimentally on protein-enriched food and compared with controls fed on sorghum or wheat. Protein enrichment was by fish meal or by soybean meal. All fish fed in addition on natural foods in the carp ponds. At low stocking rates there was no significant difference in the weight growth of experimental fish as against the controls, but there was greater fat accumulation in the controls, and protein growth was more marked in experimentals. At higher stocking rates, where there was greater demand on the proteins of the natural foods and of the sorghum or wheat, the growth of the fish was greater with the protein-enriched diets. Fish meal gave better results than soybean meal. Wheat led to lesser growth than did sorghum.--Copyright 1971, Biological Abstracts, Inc.
W72-05266

ECOLOGY AND THE REPOPULATION OF TROUT STREAMS,
Station d'Hydrobiologie Continentale, Biarritz (France).
Robin Cuinat.
Bull Franc Piscicult. 240 71-106. 1971. Illus.
Identifiers: Ecology, Population, Streams, Trout.

Repopulation or maintaining the population at certain levels involves more than just adding fish to the water. Consideration must be given to the ecological situation. The nutrition in the water must be able to support the fish since there cannot be too many predators present, and too many fish cannot be added as they will cannibalize each other. The age and life stage of the fish to be added must be considered. The natural breeding ability must also be taken into account as there can be a danger if there are too many in a given body of water. Other ecological considerations are discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-05268

NATURAL HYBRIDS OF THE AFRICAN CICHLID FISHES TILAPIA SPIRLURUS NIGRA AND T. LEUCOSTICTA: A CASE OF HYBRID INTROGRESSION,
Glasgow Univ. (Scotland). Dept. of Physiology.
H. Y. Elder, D. J. Garrod, and P. J. P. Whitehead.
Biol J Linn Soc. 3 (2): 103-146. 1971. Illus.
Identifiers: African, Cichlid, Ecological, Fishes, Hybrid, Hybrids, Introgression, Natural, Tilapia-Leucosticta, Tilapia-Spilurus-Nigra.

Hybridization is documented between 2 spp. of T. spilurus nigra and T. leucosticta. First discovered in a rice padi at Tebere in eastern Kenya (ostensibly stocked only with T. s. nigra), similar hybrids were later found in Lake Naivasha, Kenya (stocked inter alia with T. s. nigra and T. leucosticta). Hybrid characters are examined individually and by summation as a hybrid index. Pond and laboratory crosses indicate that hybridization occurs readily and produces at least partially fertile hybrids. Hybrid introgression appears to be occurring in the Tilapia populations of Lake Naivasha. Ecological features of the natural populations of both parental species and of the hybrids are examined with particular reference to habitat preferences and sex ratios.--Copyright 1971, Biological Abstracts, Inc.
W72-05270

LOCATION OF PELECUS CULTRATUS SCHOOLS IN THE SOUTHERN BUG AND DNIEPER RIVERS,
Adademiya Nauk URSR, Kiev. Instytut Zoologii.
A. Y. Shcherbukha.
Gidrobiol Zh. 7 (1): 18-22. 1971. Illus. (English summary).
Identifiers: Bug River, Characters, Distribution, Dnieper, Growth, Location, Meristic, Pelecus-Cultratus, Rivers, Schools, Southern, USSR.

In populations of P. cultratus (L.) from the lower reaches of the South Bug and Dnieper, sex differences were found by different plastic characters. The populations differ between themselves in some plastic and meristic characters as well as in some biological indices - fatness, growth rate and distribution. The differences indicate that South Bug and Dnieper species belong to isolated schools.--Copyright 1971, Biological Abstracts, Inc.
W72-05271

THE DISTRIBUTION OF AQUATIC COLEOPTERA IN ANGLESEY,
G. N. Foster.
Entomol Gaz. 22 (1): 47-54. 1971. Maps.
Identifiers: Anglesey, Aquatic, Coleoptera, Distribution, Wales.

Additional records of species from this portion of Wales, Great Britain are presented. The distribution of the species is largely determined by water pH rather than specific geological substrates.--Copyright 1971, Biological Abstracts, Inc.
W72-05272

THE MICROCLIMATE OF SIMULATED BURROWS OF BANDICOTA BENGALENSIS (G AND H.) IN CALCUTTA, INDIA (RODENTIA:MURIDAE),
World Health Organization, Taipei (Taiwan).
Carl J. Mitchell.
J Med Entomol. 8 (1): 61-67. 1971. Illus.
Identifiers: Bandicota-Bengalensis, Burrows, Calcutta, Climate, Fleas, India, Micro, Muridae, Rodentia, Simulated.

Diel and seasonal climatic changes were monitored in simulated burrows of B. bengalensis (G. and H.) and at .6 m (2 ft) above ground level in Calcutta from March 1965 through Feb. 1966. There were no marked differences in occupied and unoccupied burrows. The burrow microclimate was much more stable on a diel and seasonal basis than was the climate outside the burrows. The average relative humidity inside the burrows was 89% or greater during each month and, as a result, the average vapor pressure deficit inside the burrows never exceeded 6.4 mm of Hg during any month. Temperature was the microclimatic variable most subject to change. The monthly mean temperature in occupied burrows increased 14.6 deg C between Jan and June 1965. The possible deleterious effects of this temperature increase on the longevity of fleas inhabiting natural burrows is discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-05273

THE DISTANCES TRAVELLED BY DRIFTING INVERTEBRATES IN A LAKE DISTRICT STREAM,
Freshwater Biological Association, Ambleside (England).
J. M. Elliott.
Oecologia. 6 (4): 350-379. 1971. Illus.
Identifiers: Behavior, Distances, Drifting, Invertebrates, Lake, Mathematical, Model, Stream.

The distances travelled by drifting invertebrates of 18 taxa were investigated at sites 3 and 4 in the Wilfin Beck, a small stony stream in the English Lake District. Fifty invertebrates of the same taxon were released into the stream at increasing distances upstream from a large net which caught all invertebrates drifting downstream. The relationship between the catch in the net (Yx) and the distance from the release point to the net (Xm) was well described by the regression equation: $Yx = Ae^{-RX}$ where R is the constant relative rate of return of invertebrates to the bottom of the stream, and $A = Y0$ = number of invertebrates released at each point. The drift distance was also investigated by blocking the total drift and taking drift samples at several stations downstream from the blockage. Drift rate was markedly reduced immediately below the blockage and then gradually increased downstream until it was similar to that recorded before blocking. The mathematical model developed from the detailed experiments was a good fit to the results of the blocking experiments. The behavior of the drifting invertebrates and their ability to return to the bottom are discussed. From the results of the present study and those of other workers, it is concluded that the mathematical model is a good model for invertebrate drift. The implications of the model are discussed, especially the relationship between drift rate and water velocity, and the proportion of the benthos in the drift.--Copyright 1971, Biological Abstracts, Inc.
W72-05274

DIEL PATTERNS OF AQUATIC INVERTEBRATE DRIFT IN STREAMS OF NORTHERN UTAH,
Minnesota Univ., St. Paul.
Thomas F. Waters.
Proc Utah Acad Sci Arts Lett. 46 (2): 109-130. 1969. Illus.
Identifiers: Acroneuria, Aquatic, Baetis, Diet, Drift, Gammarus-Lacustris, Invertebrate, Patterns, Plecoptera, Rhyacophila, Streams, Trichoptera, Utah.

Several 24-hr. series of drift sampling were carried out in 8 small mountain streams and one low-gradient valley stream in the area of northeast Utah. Daily patterns with 2 peaks appeared to be the typical form of night-active periodicities; no relationship between the secondary peak and moonlight could be detected. Ephemeroptera nymphs constituted the major component of the drift in almost all streams. The ephemeropteran genus Baetis, varying in species, exhibited marked night-active drift periodicities in all streams. Other species of mayflies exhibited night-active drift periodicities still other species, though abundant on the stream bottom, characteristically did not drift appreciably. Several species of Plecoptera exhibited night-active periodicities, although some species exhibited no tendency to drift. Among the Trichoptera, one species exhibited a day-active periodicity apparently entrained by water temperature, while another species showed a night-active periodicity entrained, as with Ephemeroptera and Plecoptera, by light. The predators, Rhyacophila and Acroneuria, did not exhibit appreciable drift. In the valley stream, Gammarus lacustris did not exhibit a drift periodicity.--Copyright 1971, Biological Abstracts, Inc.
W72-05275

AMPHIPODS OF THE GENUS GAMMARUS IN THE ARCACHON BASIN, (IN FRENCH),
P. J. Labourg, S. Pinkster, and J. H. Stock.

Bijdr Dier. 41 (1): 31-36 1971. Maps. English summary.
Identifiers: Amphipods, Ant, Arcachon, Basin, Distribution, Ecology, France, Gammarus, Gammarus-Aequicauda, Gammarus-Duebeni, Genus.

Five species of the genus Gammarus were found in and around the Basin of Arcachon (southwestern France). Short notes on the autecology of these species are given. Literature records of G. duebeni and of G. aequicauda from the Basin rest on confusion with other species, as is proved by re-examination of the original material and by renewed sampling on the localities mentioned in the literature.--Copyright 1971, Biological Abstracts, Inc.
W72-05276

ECOLOGY OF FRESHWATER FISHES IN AMAZONIA: PRESENT STATE OF KNOWLEDGE AND FUTURE PROBLEMS, (IN GERMAN),
Max-Planck-Institut fuer Limnologie zu Ploen (West Germany).
R. Geisler, H. A. Knoppel, and H. Sioli.
Naturwissenschaften. 58 (6): 303-311. 1971. Illus. Maps. English summary.
Identifiers: Amazonia, Commercial, Ecology, Fishes, Fresh, Limnochemical, Species.

The ecological and physiological effects of extreme limnochemical conditions, prevalent in many of the Amazonian waters, on the very rich fish fauna of that river system are analyzed. Strong morphological differentiation, especially in the dentition of characoid fishes, may be related to their nutritional biology and hence to the corresponding limnological situation. Temporary changes in the chemistry of the water may influence the biology of commercial fishes as well.--Copyright 1971, Biological Abstracts, Inc.
W72-05277

ON THE IMPORTANCE OF TEMPORARY POOLS AND THEIR PROTECTION, (IN RUMANIAN),
Academia R.S.R., Bucharest (Rumania). Institutul de Biologie.
Petru Banarescu.
Ocrotirea Natur. 14 (2): 155-163. 1970. Illus. English summary.
Identifiers: Frogs, Invertebrates, Pools, Protection, Salamanders.

Temporary ponds serve as breeding areas for frogs and salamanders and as habitat of several invertebrate species. The author believes that some of the ponds should be preserved for maintaining some of these animals.--Copyright 1971, Biological Abstracts, Inc.
W72-05278

2J. Erosion and Sedimentation

SHEET EROSION ON INTERMOUNTAIN SUMMER RANGES,
Richard O. Meeuwig.
US Forest Serv Res Pap Int. 85. 1-25. 1970. Illus.
Identifiers: Erosion, Inter, Mountain, Ranges, Sheet, Summer.

Simulated rain was applied to small plots on 7 mountain rangeland sites in Utah, Idaho, and Montana. Multiple regression equations were developed for each site relating the resultant erosion to cover characteristics, soil properties, and slope gradient. The magnitude of erosion was found to be dependent primarily on the proportion of the soil surface protected from direct raindrop impact by plants, litter, and (in some cases) stone. Soil organic matter favored stability of fine-textured soils, but apparently increased erodibility of sandy soils. The regression equations are presented in tabular and nomographic form to aid in the assessment of potential sheet erosion on sites similar to those studied.--Copyright 1971, Biological Abstracts, Inc.
W72-04777

CAUSES OF SPHEROIDAL WEATHERING,
Canberra Coll. of Advanced Education (Australia).
C. D. Ollier.
Earth-Science Reviews, Vol 7, No 3, p 127-141, August 1971. 6 fig, 30 ref.

Descriptors: *Weathering, Soil formation, Water chemistry, Erosion, Hydration, Geochemistry.
Identifiers: *Spheroidal weathering.

Spheroidal weathering, in which concentric shells completely surround a corestone, is reviewed. After a brief description of field observations, the many suggested causes of spheroidal weathering are discussed. Hypotheses proposed involve expansion (produced in various ways), unloading, constant-volume alteration, Liesegang phenomena, micro-cracks, and several minor or special-case mechanisms. The term 'spheroidal weathering' applies to several different features formed in different ways. (Knapp-USGS)
W72-04794

A GEOCHEMICAL DRAINAGE SURVEY AND ITS IMPLICATIONS FOR METALLOGENESIS, CENTRAL COAST MOUNTAINS, BRITISH COLUMBIA,
Princeton Univ., N.J. Dept. of Geological and Geophysical Sciences.
For primary bibliographic entry see Field 02K.
W72-04798

COASTAL SEDIMENTATION OF SOUTHEASTERN LAKE MICHIGAN, FIELD TRIP GUIDEBOOK,
Western Michigan Univ., Kalamazoo. Dept. of Geology.
W. T. Fox, R. T. Kerhin, R. A. Piccolo, and L. J. Standing.
Western Michigan University Studies in Geology No 1, November 13, 1970. 50 p, 12 fig, 14 ref.

Descriptors: *Sedimentation, *Coasts, *Lake Michigan, *Surveys, *Sediment transport, Hydrologic data, Data collections, Sedimentology, Particle size, Sands, Forecasting, Water levels, Beaches, Water circulation, Currents (Water), Sediment yield.

Ten short papers contributed by 5 students at Western Michigan University are presented concerning sedimentation projects in the coastal areas of southeastern Lake Michigan. The projects include: (1) Time-Series study of foreshore zone in a non-tidal environment; (2) sediment-topography relationships in the inner-nearshore zone; and (3) longshore sediment transport near Glenn, Michigan. Coastal areas of the Great Lakes afford excellent opportunity for studies of coastal sedimentary environments. This is particularly the case for beaches and nearshore zones. The absence of appreciable tides actually is a plus factor in studying sedimentary processes. It enables one to consider the lakes as large models without having the scale problems of laboratory studies. Steadily increasing lake levels since the all time recorded lows of 1963-64 have caused extensive coastal erosion. Levels of 1969 approached the highest recorded levels and caused more than 20,000,000 dollars in property loss and damage. Beach studies during cycles of lake level changes can aid in predicting rates or erosion and accretion for future changes. (Woodard-USGS)
W72-04807

ELECTION MICROGRAPHS OF LAKE KINNERET SEDIMENTS,
Hebrew Univ., Rehovoth (Israel). Dept. of Soil Science.
A. Singer, A. Banin, and M. Gal.
Israel Journal of Earth-Sciences, Vol 20, No 3, p 125-128, 1971. 7 fig, 11 ref.

Descriptors: *Sedimentology, *Lakes, *Electron microscopy, *Sediments, Analytical techniques, Instrumentation, Clays, Particle size, Water chemistry, Ion exchange, Geochemistry.

Electron microscopy techniques were used to examine dredge samples of recent bottom sediments from Lake Kinneret in Israel. Lake Kinneret sediments are composed of organic matter, carbonates and silicates. Most of the silicates are in the form of clay minerals, which comprise more than 60% of the noncarbonates over more than one-half of the lake bottom area. The predominance of clay sized minerals in sediments have an important bearing on the chemical composition of the interstitial waters. Salinity in these may increase, an effect observed in many fine-grained sediments and attributed to the behavior of ion-exchanging clays acting as semipermeable membranes that concentrate salts. Furthermore, mineral equilibria between the predominantly montmorillonitic clays in the Kinneret sediments and interstitial water may especially affect the concentration of Si, Mg, and K, which are lattice components of this clay mineral. (Woodard-USGS)
W72-04810

SOIL-DESICCATION FEATURES IN SOUTH DAKOTA DEPRESSIONS,
South Dakota State Univ., Brookings. Dept. of Plant Science.
For primary bibliographic entry see Field 02G.
W72-04812

MORPHOGENESIS OF GRANITIC BOULDER SLOPES IN THE MOJAVE DESERT, CALIFORNIA,
California Univ., Berkeley. Dept. of Geography.
T. M. Oberlander.
Journal of Geology, Vol 80, No 1, p 1-20, January 1972. 14 fig, 1 tab, 39 ref.

Descriptors: *Geomorphology, *Weathering, *California, *Paleoclimatology, Land forming, Erosion, Joints (Geology), Deserts, Topography.
Identifiers: Mojave Desert (Calif).

In the western Mojave Desert, current weathering of exposed granitic rocks is not renewing the boulder mantles characteristic of this region. Boulder mantles are presently disintegrating to expose massive outcrops that change thereafter only by the detachment of exfoliation shells. The existing boulders were originally isolated as corestones by subsurface chemical weathering and were exposed by the stripping of a thick weathered mantle formed during periods of greater moisture availability. North of the San Bernardino Mountains deep-weathering profiles characterized by brick red surface horizons, rubefied calcrete crusts, and the presence of corestones in a frus matrix are widely encountered beneath basaltic remnants having radiometric ages in excess of 8 m.y. The gradual onset of aridity during the later Tertiary terminated subsurface weathering and accelerated surface erosion, bringing about the massive exposure of Tertiary corestones and the joint-controlled Tertiary weathering front. Slope retreat and pedimentation occurred here in the presence of a soil cover; thus the extensive granitic pediments of the region are also relict forms inherited from the Tertiary landscape. (Knapp-USGS)
W72-04813

PEAKING-STATION LAYOUTS ON HIMALAYAN RIVERS,
Kishau Dam Planning Div., Dehra Dun (India).
For primary bibliographic entry see Field 04A.
W72-04875

ORGANIC CARBON AND NITROGEN IN THE SURFACE SEDIMENTS OF LAKES ONTARIO, ERIE AND HURON,
Department of Energy, Mines and Resources, Burlington (Ontario). Canada Centre for Inland Waters.
For primary bibliographic entry see Field 02H.
W72-05003

EFFECTS OF SILTATION AND COARSER SEDIMENTS ON DISTRIBUTION AND ABUNDANCE OF STREAM-INHABITING INSECTS,
Idaho Univ., Moscow. Water Resources Research Inst.
For primary bibliographic entry see Field 05C.
W72-05024

WIND STRESS CRITERIA IN EOLIAN SAND TRANSPORT,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
S.-A. Hsu.
Journal of Geophysical Research, Vol 76, No 36, p 8684-8686, December 20, 1971. 3 fig, 9 ref. ONR N00014-69-A-0211-0 NR 388 002.

Descriptors: *Beach erosion, *Shear, *Winds, *Velocity, *Sediment transport, Sands, Sand waves, Mathematical studies, Equations, Data collections, Model studies, Particle size, Oceans, Beaches, Coasts.
Identifiers: *Ecuadorian beaches.

The linear relationship between shear velocities and wind velocities was verified from field data collected on Ecuadorian beaches during periods of sand transport. From these data a Froude number was established that expresses the relationship among wind stress, gravity acceleration, and mean grain size of sand particles. The rate of eolian sand transport was scaled by using this number. The concept was verified by available field and wind tunnel data. The equation is expressed as follows: q = K f cubed where q is the rate of eolian sand transport, K is the eolian sand transport coefficient with the same dimension as q, and f is the Froude number. (Woodard-USGS)
W72-05037

THE MEASUREMENT OF SMALL SOIL DISPLACEMENTS ON A DUTCH HILLSLOPE,
Technische Hogeschool, Delft (Netherlands). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02G.
W72-05040

A NOTE ON INEXPENSIVE TELEMETRY OF RIVER SEDIMENT CONCENTRATIONS,
Natal Univ., Pietermaritzburg (South Africa).
For primary bibliographic entry see Field 07B.
W72-05049

AN INVESTIGATION ON SLOPE EROSION BY MELTWATER OF SNOW-PATCHES IN MT. GASSAN, (IN JAPANESE),
Shinshu Univ., Matsumoto (Japan). Dept. of Geography.
Makoto Kobayashi.
Bull Inst Nat Educ Shiga Heights. 8. 1-15. 1969. Illus. English summary.
Identifiers: Erosion, Gassan, Japan, Melt, Patches, Rainfall, Slope, Snow, Vegetation.

Amount of debris flow washed down by meltwater was very small (several milligrams/half a liter of meltwater) without distinction of types of vegetation and soil on the slopes. It is believed that the action of slope erosion by meltwater is slight. However, during rainfall the amount of debris flow rapidly increased and was much larger on the slopes of no vegetation than on those of hygrophytic vegetation.--Copyright 1971, Biological Abstracts, Inc.
W72-05218

2K. Chemical Processes

METHODS FOR CHEMICAL ANALYSIS OF WATER AND WASTES, 1971.
National Environmental Research Center, Cincinnati, Ohio. Analytical Quality Control Lab.
For primary bibliographic entry see Field 05A.
W72-04735

POTASSIUM FLUORIDE - A REFERENCE STANDARD FOR FLUORIDE ION ACTIVITY,
Florida Univ., Gainesville. Dept. of Chemistry.
For primary bibliographic entry see Field 05A.
W72-04741

RECORDS OF WELLS, DRILLERS' LOGS, AND CHEMICAL ANALYSIS OF GROUND WATER IN GALVESTON COUNTY, TEXAS 1952-1970,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 04B.
W72-04795

A GEOCHEMICAL DRAINAGE SURVEY AND ITS IMPLICATIONS FOR METALLOGENESIS, CENTRAL COAST MOUNTAINS, BRITISH COLUMBIA,
Princeton Univ., N.J. Dept. of Geological and Geophysical Sciences.
G. J. Woodsworth.
Economic Geology, Vol 66, No 8, p 1104-1120, December 1971. 11 fig, 4 tab, 31 ref.

Descriptors: *Sediments, *Sampling, *Geochemistry, *Distribution patterns, *Exploration, Mining, Mineralogy, Surveys, Mapping, Alluvium.
Identifiers: *British Columbia, *Geochemical prospecting.

Two thousand stream sediment samples from 3,300 square miles of the Central Coast Mountains of British Columbia were analyzed for Mo, Cu, Zn, and cold-extractable copper. The data were grouped according to the lithologies underlying the drainage basins, and the distributions and interrelationships of the trace metals were examined using cumulative frequency plots and simple statistical methods. Positive correlations between mean Cu and Zn contents of stream sediment samples and mean specific gravity of associated plutonic rocks result principally from variations in the mafic mineral content of the plutonic rocks. Samples containing anomalous metal values were obtained from streams draining most known skarn, massive sulfide, and pegmatitic deposits in the areas sampled. Relatively simple statistical techniques are useful in interpreting geochemical prospecting data in some cases where more sophisticated techniques cannot usefully be applied. Reconnaissance stream sediment surveys in the central Coast Mountains are useful both in prospecting for massive sulfide deposits and in metallogenic studies. (Knapp-USGS)
W72-04798

GEOCHEMICAL MASS BALANCE AMONG LITHOSPHERE, HYDROSPHERE, AND ATMOSPHERE,
Harvard Univ., Cambridge, Mass. Dept. of Geological Sciences.
Y. -H. Li.
American Journal of Science, Vol 272, No 2, p 119-137, February 1972. 2 fig, 3 tab, 40 ref, append.

Descriptors: *Sediments, *Geochemistry, Weathering, Erosion, Stable isotopes, Oxygen, Oxidation, Sedimentation, Paleoclimatology.
Identifiers: *Geochemical mass balance.

Total sedimentary mass of the Earch was calculated to be 2.4 times 10 to the 24th power by a model using oxygen-mass balance relationships. Mean residence time of sediments is 210 million years. In the weathering of 100 g of igneous rock, about 113 g of sediments is produced. The relative weight abundance of rock types obtained from the model is evaporite: carbonate: sandstone: shale+clay=2:15:12:71. The gross distribution of sedimentary mass as a function of age observed today cannot give a definite clue to the degassing model of the primary volatiles but an asymptotic degassing model is preferred. The total mass of deep oceanic sediments is more or less in a steady state today, with a mean residence time of sediments in the ocean of 170 million years. (Knapp-USGS)
W72-04814

WATER CHEMISTRY OF THE SANTA CLARA VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
R. C. Averett, P. R. Wood, and K. S. Muir.
Geological Survey Open-file Report, March 26, 1971. 24 p, 1 fig, 7 tab, 18 ref.

Descriptors: *Groundwater, *Water quality, *Water chemistry, *Groundwater movement, *California, Trace elements, Water analysis, Chemical analysis, Water supply, Water users, Hydrogeology, Percolation.
Identifiers: *Santa Clara Valley (Calif), Imported water.

The Santa Clara County, California Flood Control and Water District takes delivery of imported water which, in part, is percolated and stored in the groundwater reservoir of the Santa Clara Valley. The District has the responsibility for the taxation of water used, and for insuring that the imported water is adequate for municipal, industrial, and agricultural uses. Concentrations of minor elements present in the waters are tabulated. The feasibility of using these minor elements to trace the movement of water percolated into the ground is discussed. Water within the Santa Clara Valley is generally a calcium or magnesium bicarbonate type. However, water samples collected from the Sacramento-San Joaquin system at Tracy, Calif., were predominately a sodium chloride type, but there is a seasonal change in the predominant ions of the imported water. For example, in September 1965, the chief ions of the imported water were sodium and chloride; in June 1968, they were sodium and bicarbonate. These changes are not surprising because the Sacramento and San Joaquin Rivers receive considerable irrigation-return water, which influences the concentrations of the predominant ions. (Woodard-USGS)
W72-04835

RECORDS OF WELLS, SPRINGS, AND TEST BORINGS, CHEMICAL ANALYSES OF WATER, SEDIMENT ANALYSES, STANDARD STREAMFLOW DATA SUMMARIES, AND SELECTED DRILLERS' LOGS FROM THE LITTLE KANAWHA RIVER BASIN IN WEST VIRGINIA,
Geological Survey, Charleston, W. Va. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-04841

DETERMINATION OF TRITIUM IN WATER BY THE U.S. GEOLOGICAL SURVEY, DENVER, COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 05A.
W72-04842

DESCRIPTIONS AND CHEMICAL ANALYSES FOR SELECTED WELLS IN THE DOS PALOS--KETTLEMAN CITY AREA, SAN JOAQUIN VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
G. L. Bertoldi, and R. A. LeBlanc.
Geological Survey Open-file Report, 1969. 24 p, 2 fig, 3 tab, 1 ref.

Descriptors: *Groundwater, *Water wells, *Water analysis, *Chemical analysis, *California, Water chemistry, Water quality, Aquifers, Water utilization, Water supply.
Identifiers: *San Joaquin Valley (Calif).

Between July 15 and September 20, 1968, water samples were collected from 361 wells in the Dos Palos-Kettleman City area, California for chemical analysis. In addition to tables of chemical analyses, data include well locations and well descriptions. The Dos Palos-Kettleman City area is in the central-western part of the San Joaquin Valley, south and east of the MercedFresno county line, north and west of State Highway 41, east of the Diablo Range, and west of the San Joaquin River, Fresno Slough Bypass, Fresno Slough, and Kings River. It encompasses about 1,350 square miles, approximately 1,200 in western Fresno County and 150 in northwestern Kings County. (Woodard-USGS)
W72-04843

CONTRIBUTIONS TO THE GENESIS AND CLASSIFICATION OF MARSH SOILS: II. ON THE SULPHUR METABOLISM OF MUDS AND SALT MARSHES, (IN GERMAN),
Kiel Univ. (West Germany). Institut fuer Pflanzenernaehrung und Bodenkunde.
For primary bibliographic entry see Field 02G.
W72-04924

RECURRENCE RELATIONS FOR FIRST ORDER SEQUENTIAL REACTIONS IN NATURAL WATERS,
Manhattan Coll., Bronx, N.Y. Environmental Engineering and Science Program.
For primary bibliographic entry see Field 05B.
W72-05027

CATION ADSORPTION IN ONE-DIMENSIONAL FLOW THROUGH SOILS: A NUMERICAL SOLUTION,
Utah State Univ., Logan. Dept. of Soil Science and Biometeorology.
For primary bibliographic entry see Field 02G.
W72-05031

EFFECT OF UPWELLING, MIXING, AND HIGH PRIMARY PRODUCTIVITY ON CO2 CONCENTRATIONS IN SURFACE WATERS OF THE BERING SEA,
Alaska Univ., College. Inst. of Marine Sciences.
J. J. Kelley, L. L. Longerich, and D. W. Hood.
Journal of Geophysical Research, Vol 76, No 36, p 8687-8693, December 20, 1971. 7 fig, 14 ref. ONR N00014-64-A0317-0001AB and NSF 276-8024 and GD 27253.

Descriptors: *Carbon dioxide, *Mixing, *Surface waters, *Oceans, *Sea water, Water chemistry, Salinity, Nitrates, Chemical analysis, Sampling, Surveys.
Identifiers: *Bering Sea, Upwelling.

Late spring and early fall measurements were made of carbon dioxide concentration in Bering Sea surface waters north of Amukta and Samalga passes in the eastern Aleutian Islands. High values of CO2, NO3-N, and salinity were accompanied by low oxygen and temperature values. All the isopleths of these parameters give evidence of vertically mixed water. Seasonal variation of CO2 in surface waters was observed particularly in areas of low vertical mixing and high productivity. (Woodard-USGS)
W72-05038

COMPLEXES OF HALLOYSITE WITH ORGANIC COMPOUNDS,
Otago Univ., Dunedin (New Zealand). Dept. of Chemistry.
R. M. Carr, and H. Chih.
Clay Minerals, Vol 9, No 2, p 153-166, December 1971. 3 tab, 15 ref.

Descriptors: *Geochemistry, *Mineralogy, *Clays, *Water of hydration, *Hydrates, Organic compounds, Analytical techniques, X-ray diffraction, Water chemistry, Chemical reactions.
Identifiers: *Halloysite.

More than twenty new organic complexes of halloysite have been prepared and one hundred and twenty-seven compounds were tested. Results are compared with those of earlier studies and use is made of recent findings concerning particle morphology and interstratification effects to interpret the results. The compounds which form complexes with halloysite are polar. Their molecules usually contain two functional groups (preferably -OH and/or -NH2), are relatively small and have one functional group per two carbon atoms, but do not usually include cyclic or aromatic types. The best explanation of the existence of these metastable complexes lies in the ability of some organic molecules to form hydrogen bonds with the halloysite structure. (Woodard-USGS)
W72-05043

ESCA--THE NEW SPECTROSCOPY,
Waterloo Univ. (Ontario). Dept. of Chemistry.
F. W. Karasek.
Research/Development, Vol 23, No 2, p 30-34, February 1972. 8 fig, 10 ref.

Descriptors: *Chemical analysis, *Spectroscopy, *Instrumentation, *Analytical techniques, *Spectrometers, X-ray spectroscopy, Reviews, Evaluation.
Identifiers: *Electron spectroscopy.

Electron spectroscopy produces a high resolution energy spectrum of electrons ejected from a molecule after interaction with a monoenergetic beam of x-rays, photons or electrons. Each ionizing source provides a different type of spectrum, all of which can be used for chemical analysis. Although historically the term ESCA-electron spectroscopy for chemical analysis-originated around the work of Siegbahn and his associates, work that began as early as 1946 and came to practical realization in 1964, the term has now come to embrace all of these types of electron spectroscopy. Electron spectroscopy essentially analyzes the surface, the deepest penetration of the sample being only 100 angstroms. Data aquisition systems include a small digital computer to facilitate control of the spectrometer and to store, process and display the data. The essential components of the instrumentation are illustrated. The sources used are X-ray tubes, ultraviolet generators and electron guns. In each case the aim is to produce a very monochromatic stable beam of relatively high intensity. (Woodard-USGS)
W72-05051

SPECIFIC CONDUCTANCE MODEL FOR NATURAL WATERS AND SOIL SOLUTIONS OF LIMITED SALINITY LEVELS,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02G.
W72-05053

WATER RESOURCES DATA FOR WISCONSIN, 1969: PART L. SURFACE WATER RECORDS, AND PART 2. WATER QUALITY RECORDS.
Geological Survey, Madison, Wis. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-05094

CATION EXCHANGE SELECTIVITY OF SOME CLAY-SIZED MINERALS AND SOIL MATERIALS,
Wisconsin Univ., Madison. Dept. of Soil Science.
D. L. Dolcater, E. G. Lotse, J. K. Syers, and M. L. Jackson.
Soil Science Society of America Proceedings, Vol 32, No 6, p 795-798, November-December, 1968. 3 fig, 6 tab, 20 ref.

Descriptors: *Cation exchange, *Montmorillonite, Clay minerals, Clays, Soil physical properties.
Identifiers: *Soil clays, Mica, Vermiculite.

Cation exchange selectivity (CES) values for montmorillonite, vermiculite, biotite, muscovite, and micaceous vermiculitic clays from Triangle and Harpster soils were determined by equilibration of each exchanger with a mixed, equinormal solution containing two competing cations. The cation affinity of Na-saturated materials increased in the order K<Mg<Ca<Sr<Ba for montmorillonite and the soil clays, Mg<K<Ca<Sr<Ba for biotite, Mg<Ca<Sr<K<Ba for muscovite, and K<Ba<Sr<Ca<Mg for vermiculite. Sodium-saturated micaceous vermiculite gave a K/Ca CES value of 0.2, whereas K-saturated, dried vermiculite gave a K/Ca CES value of 0.4, indicating that the large number of interlayer wedge sites produced by the structural collapse in K-saturated and dried vermiculite increased the selectivity for K ions. Potassium-saturated and dried muscovite having a CEC equal to the similarly treated vermiculite gave a K/Ca CES value of 4.0 compared to 0.4 for the vermiculite, suggesting that layer charge density has a large influence upon K selectivity. The higher CES values for muscovite relative to those for biotite are explained by the smaller ditrigonal holes and the oblique orientation of hydroxyl groups in the muscovite structure. (Skogerboe-Colorado State)
W72-05127

THE EFFECT OF WATER ACTIVITY ON ION EXCHANGE SELECTIVITY IN CLAYS,
Louvain Univ. (Belgium).
For primary bibliographic entry see Field 02G.
W72-05135

PROPERTIES OF SOME NATURAL WATERS IN A TROPICAL WET FOREST OF COSTA RICA,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
J. G. McColl.
Bioscience. 20 (20): 1096-1100. 1970. Illus.
Identifiers: Costa-Rica, Forest, Litter, Natural, Rainfall, Soil, Solution, Stemflow, Tropical.

Rainfall, throughfall, stemflow, litter solution, soil solution, and drainage water were sampled in Costa Rica during Nov., 1969. The study site was in a tropical lowland wet forest. Concentrations of Ca, Mg, Na, Mn, K, H, Fe, HCO3, P, and N, and pH and electrical conductivity were determined for bulked samples of these waters. Conductivity, pH, and rates of flow of water at a number of places in the ecosystem were also monitored during a rainstorm. Drainage water from 5 sources had characteristic conductivities, 4 of which were relatively constant over the study period. These conductivities reflected the saturated conditions of the study period, and the land-use and other characteristics of the watersheds. The data are compared with those for other forest ecosystems, from both tropical and temperate regions.--Copyright 1971, Biological Abstracts, Inc.
W72-05194

2L. Estuaries

THE FOOD AND FEEDING HABITS OF TILAPIA SPECIES IN THE LAGOS LAGOON,
Lagos Univ. (Nigeria). School of Biological Science.
S. O. Fagade.
J Fish Biol. 3 (2): 151-156. Map. 1971.
Identifiers: Competition, Feeding, Food, Habits, Lagoon, Lagos, Nigeria, Species, Tilapia, Tilapia-Guineensis, Tilapia-Mariae, Tilapia-Melanotheron-Melanotheron.

The food of T. mariae (Boulenger), T. guineensis (Bleeker) and T. melanotheron melanotheron (Rupell) were investigated. It is shown the T. guineensis and T. m. melanotheron which were the more

abundant species had similar food habits. The intensity of feeding of both species and the possible competition for food between them are discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-04705

THE DISTRIBUTION AND NET PRODUCTIVITY OF SUBLITTORAL POPULATIONS OF ATTACHED MACROPHYTIC ALGAE IN AN ESTUARY ON THE ATLANTIC COAST OF SPAIN,
Durham Univ. (England). Dept. of Botany.
For primary bibliographic entry see Field 05C.
W72-04766

MOLLUSKS AND BENTHIC ENVIRONMENTS IN HILLSBOROUGH BAY, FLORIDA,
Bureau of Commercial Fisheries, St. Petersburg Beach, Fla. Biological Lab.
John L. Taylor, John R. Hall, and Carl H. Waloman.
US Fish Wildl Serv Fish Bull. 68 (2): 191-202. 1971. Illus, Maps.
Identifiers: Bay, Benthic, Crassostrea-Virginica, Environments, Florida, Hillsborough, Mollusks, Pollution.

Analysis of benthic mollusks and sediments at 45 stations showed that the diversity and abundance of mollusks was affected by bottom conditions which were influenced in varying degrees by domestic and industrial pollution and dredging. Nineteen stations had no living mollusks, 18 stations had 1 or more of the 4 mollusk spp. that were predominant, and 8 stations had mollusks well represented by numerous species and large numbers of individuals. Stations with no living mollusks were termed unhealthy, and others were designated marginal or healthy on the basis of the mollusks present. From station data, isopleths connecting similar areas indicated that 42% of the bay bottom was unhealthy, 36% marginal, and 22% healthy. Infrequent occurrence of the American oyster (Crassostrea virginica) further suggests that the major portion of Hillsborough Bay was seriously contaminated. An appendix has a checklist of the 64 spp. of mollusks collected in the bay.--Copyright 1971, Biological Abstracts, Inc.
W72-04772

AN INTERSECTORAL PROGRAMMING MODEL FOR THE MANAGEMENT OF THE WASTE WATER ECONOMY OF THE SAN FRANCISCO BAY REGION,
Technion-Israel Inst. of Tech., Haifa. School of Engineering.
For primary bibliographic entry see Field 05B.
W72-04780

SALTY GROUND WATER AND METEORIC FLUSHING OF CONTAMINATED AQUIFERS IN WEST VIRGINIA,
Environmental Protection Agency, Wheeling, W. Va.
For primary bibliographic entry see Field 05B.
W72-04801

RESULTS OF A FIELD STUDY USING THE 3-AXIS DOPPLER SHIFT CURRENT METER,
John Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
R. C. Seitz.
Chesapeake Bay Institute Technical Report 72 (Reference 71-6), John Hopkins University, September 1971. 80 p, 28 fig, 9 tab, 8 ref, 2 append. NR 083-016, N00014-67-A-0163-0006 (ONR).

Descriptors: *Streamflow, *Estuaries, *Tidal waters, *Flow rates, *Current meters, Instrumentation, Data collections, Hydrologic data, Water temperature, Salinity, Currents (Water), Winds, Velocity, Waves (Water), Analytical techniques.
Identifiers: *Doppler current meter, *Patuxent estuary (Md).

During the spring of 1967 a study was made for 18 days with the 3-axis Doppler shift (acoustic) current meter in the Patuxent Estuary. Continuous measurements of 3-dimensional water velocities were obtained in fields of naturally occurring turbulence. The meter was mounted on a fixed tower in the estuary. The measurements (made 1, 2, and 3 meters above the bottom of the estuary) were supplemented with data concerning the vertical structure of temperature, salinity, and currents in the estuary, continuous wind speed and direction measurements, and in some instances surface wave measurements. The main factor in limiting the range of the isotropic energy toward lower wave numbers is the distance to the boundary for the measurement at 1 meter and density stratification for the measurements at 2 and 3 meters. Relationships between the constant stress layer parameters are compared to the results found by others in the atmospheric boundary layer. A theory is put forth to explain the vertical velocities which is based upon the effects of bottom topography upon mean tidal velocities. (Woodard-USGS)
W72-04817

VOLUMETRIC, AREAL, AND TIDAL STATISTICS OF THE CHESAPEAKE BAY ESTUARY AND ITS TRIBUTARIES,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
W. B. Cronin.
Chesapeake Bay Institute Special Report 20 (Reference 71-2), Johns Hopkins University, March 1971. 135 p, 7 fig, 5 tab, append.

Descriptors: *Estuaries, *Bays, *Water measurement, *Tidal waters, *Hydrologic data, Data collections, Water yield, Volume, Areal cross-sections.
Identifiers: *Chesapeake Bay, *Chesapeake Bay tributaries.

Areal, volumetric, and tidal statistics for the Chesapeake Bay and its tributaries include cross-section areas, surface areas, average depths, mean low water volumes, hourly intratidal volumes, mean high water volumes, intertidal volumes as a percentage of the mean high water volumes, and accumulation of these data from mouth to head and from head to mouth of all tributaries and of the Bay proper. These are given for each nautical mile of the estuarine system with accumulations at 5 mile segments and totals. Tidal statistics are related to a common reference station, Hampton Roads, Virginia, and include times of high water, times of low water, durations of rise and fall, and tidal ranges, for each five mile segment of the estuarine system. (Woodard-USGS)
W72-04838

ANNUAL PHYTOPLANKTON CYCLE OF THE CAPE FEAR RIVER ESTUARY, NORTH CAROLINA,
Woods Hole Oceanographic Institution, Mass.
Edward J. Carpenter.
Chesapeake Sci. 12 (2): 95-104. 1971. Illus.
Identifiers: Annual, Blooms, Cape, Chrysophytes, Cyanophytes, Cycle, Estuary, Euglenoid, Fear, Flagellates, Formula, North-Carolina, Phyto, Plankton, River, Shannon, Skeletonema-Costatum.

Monthly phytoplankton samples were taken in the lower Cape Fear River estuary at 3 stations from the estuary mouth to 8 km upriver. Surface salinity ranged from 16 to 35% near the estuary mouth and from 2 to 26% 8 km upriver, and surface water temperatures ranged from 4.5 C in Jan. to 30.0 C in July. A total of 203 spp. were observed in the estuary, consisting of 134 diatoms, 25 chlorophytes, 15 dinoflagellates, 9 cryptomonads, 9 cyanophytes, 3 chrysophytes, 3 xanthophytes, 2 haptophytes, 2 loricate flagellates, and 1 euglenoid flagellate. The phytoplankton was dominated by the diatom Skeletonema costatum, which averaged 28.7% of the total cell numbers through the year. S. costatum, and 5 other species consisting of 2 diatoms, 1 cryptomonad, 1 dinoflagellate, and 1 loricate flagellate, were the major phytoplankters. Average cell numbers in the estuary were 1.69 x 10 to the 6th power cells/liter, and the maximum and minimum were 7.3 x 10 to the 6th power and 0.25 x 10 to the 6th power cells/liter. The major population bloom was in May and June in 1969 and appeared to start in Feb. in 1970. Phytoplankton species diversity was calculated with the Shannon formula and showed greater average diversity at the mouth of the estuary.--Copyright 1971, Biological Abstracts, Inc.
W72-04902

A TEN-YEAR STUDY OF MEROPLANKTON IN NORTH CAROLINA ESTUARIES: ANNUAL OCCURRENCE OF SOME BRACHYURAN DEVELOPMENTAL STAGES,
North Carolina Univ., Morehead City. Inst. of Marine Science.
Austin B. Williams.
Chesapeake Sci. 12 (2): 53-61. 1971.
Identifiers: Annual, Brachyuran, Callinectes-Sapidus, Developmental, Estuaries, Hexapanopeus-Angustifrons, Mero, North-Carolina, Plankton, Rhitropanopeus-Harrisii, Year.

Seasonal occurrence of brachyuran developmental stages is predictable in meroplankton collected inside the barrier islands of North Carolina near inlets and along longitudinal transects of the larger estuaries. Nets of 1 mm mesh employed in the sampling program limited catches to larger zoeae and megalopae, and of these only a fraction can be identified with precision. Callinectes megalopae were taken in every month of the year and through almost the entire length of the estuary. Evidence indicates that this post-larval stage is active in surface waters at night, contributing substantially to dispersal of the species, probably C. sapidus in this case. Hexapanopeus angustifrons megalopae were limited to the warm season in samples from a single station near Beaufort Inlet. Rhithropanopeus harrisii zoeae and megalopae were distributed abundantly in oligo-mesohaline waters of Neuse and Pamlico Rivers. Showing no nocturnal stratification, the stages were present continuously from June to Oct. Megalopae of all these species, usually considered benthic in habit, are readily captured in surface waters at night.--Copyright 1971, Biological Abstracts, Inc.
W72-04903

DAYLIGHT INCUBATOR ESTIMATES OF PRIMARY PRODUCTION IN THE MOUTH OF THE PATUXENT RIVER, MARYLAND,
Maryland Univ., Solomons. Natural Resources Inst.
David A. Flemer, and Janet Olmon.
Chesapeake Sci. 12 (2): 105-110. 1971. Illus.
Identifiers: Day, Incubator, Light, Maryland, Mouth, Patuxent, Photosynthesis, Primary, Production, River.

Ten daylight incubator estimates of primary production were performed at the mouth of the Patuxent estuary, Maryland, during the warm season of 1967. Daytime gross and net photosynthesis ranged from 1.10 to 3.75 and -0.39 to 2.57 g C m-2 respectively. An assumed photosynthetic quotient of 1.0 was required to usually give positive estimates of 24-hr net production based on changes in dissolved O2. Photosynthetic output per unit chlorophyll a was quite uniform from 100 to 16% of the surface insolation. Efficiency of daytime gross integral photosynthesis ranged between 0.5 and 2.6%.--Copyright 1971, Biological Abstracts, Inc.
W72-04904

EFFECTS OF PHOSPHORUS MINING WASTES ON THE GROWTH OF PHYTOPLANKTON IN THE PAMLICO RIVER ESTUARY,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05C.
W72-04906

STUDIES ON TELLINA TENUIS DA COSTA: III. ASPECTS OF GENERAL BIOLOGY AND ENERGY FLOW,
Marine Lab., Aberdeen (Scotland).
Ann Trevallion.
J Exp Mar Biol Ecol. 7 (1): 95-122. 1971. Illus.
Identifiers: Biology, Energy, Flow, Food, Invertebrates, Phaeodactylum, Plaice, Plankton, Predator, Tellina-Tenuis.

During a 4-yr study of food chains in Lock Ewe, west Scotland, the bivalve T. tenuis da Costa was studied. Data have been collected for 2 populations in Loch Ewe, 1 in Firemore Bay, and 1 in Inverasdale. Another population in nearby Gruinard Bay, was also sampled. T. tenuis occurs from mid-tide level down to a few metres below low water. It lies in the sand at a depth of a few centimetres, generally on its left side. The inhalant siphon extends vertically into the water column while faeces and water are expelled through the exhalant siphon which is extended into the sand horizontally below the surface. Food is probably obtained mainly from the sand-water interface, and the siphons do not normally extend far above the surface. Experimentally, low O2 content, extremes of temperature, and lack of food may stimulate the inhalant siphons to extend further into the water. At low tide it is thought that Tellina takes in interstitial water, and with it some sand grains. Filtration rates were 20-60 ml/h for animals of 15-20 mg dry weight, giving ingestion of at least 250 microgram of particulate organic matter per day if active filtration occurs during 50% of the time. Oxygen uptake was measured over the natural temperature range throughout the year and 6 mg O2/g/day has been suggested as a mean value for the year. The inhalant siphons are preyed upon by 0-group plaice. The extent of predation varied. Changes are partly due to changes in the relative density of predator and prey, and also in the abundance of other prey species. Siphon regeneration occurs at the rate of about 0.3 mg/week. The 'condition' (dry flesh weight of a standard animal) of Tellina from the 3 beaches shows a similar seasonal pattern, low values in winter, a rise in the spring, one or two peaks in the summer, and a fall in the autumn to the low winter values. The peaks are largely due to gonad proliferation, with a sudden decrease on spawning. The 'condition' of Tellina at the 3 localities has improved from 1967 to 1968, and in Firemore has improved steadily since 1965. The seasonal pattern of growth follows closely the changes in temperature. Northerly winds may have an adverse effect on the condition of Tellina in Loch Ewe since they give rise to a swell and so to sand disturbance. In 1968 there was more bright sunshine and less rain than in the three previous years and this may partly explain the good growth and condition of Tellina in that year. Similarly, high rainfall and fewer hours of sunshine may have had an adverse effect on Tellina in 1967. Heavy mortalities and very small recruitment to the population of Tellina in Firemore Bay have resulted in a decrease in population. A table shows the proportion of energy channelled into growth, reproduction, siphon regeneration, and respiration. Factors which may affect the changes in production of the Tellina population in Firemore Bay are discussed, and the growth efficiency is compared with published data for some other invertebrates.--Copyright 1971, Biological Abstracts, Inc.
W72-05112

A MODERN EVAPORITE DEPOSIT IN MEXICO,
Scripps Institution of Oceanography, La Jolla, Calif.
Fred B. Phleger.
Am Assoc Petroleum Geol Bull. 53 (4): 824-829. 1969. Illus. Map.
Identifiers: Deposit, Evaporite, Mexico, Organisms, Photosynthesis.

Marine evaporites are being deposited in the Ojo de Liebre Lagoon area, Baja, California, in shallow diked basins flooded by high tides from an adjacent lagoon. Aragonite is deposited in the brine pans where daytime pH is high because of photosynthesis. Halite is deposited when wind transports brine into inner basins, and most of the gypsum is intermediate in location. Evaporites and brine support a very large standing stock of organisms.--Copyright 1971, Biological Abstracts, Inc.
W72-05161

CASPIAN FAUNA IN THE BLACK SEA (BEYOND THE LIMITS OF FRESHWATER REGIONS), (IN RUSSIAN),
Akademiya Nauk SSSR, Moscow. Institut Biologii Vnutrennykh Vod.
F. D. Mordukhai-Boltovskoi.
Gidrobiol Zh. 6 (6): 20-25. 1970. English summary.
Identifiers: Biomass, Black Sea, Caspian, Fauna, Fish, Fresh, Invertebrates, Salinity.

Six spp. of invertebrates and 13 spp. of fish are identified in the area of the Black Sea with normal salinity (17-18%). The decrease in number of species and in biomass with salinity increase is noted.--Copyright 1971, Biological Abstracts, Inc.
W72-05162

STUDIES ON THE BIOLOGY AND CULTIVATION OF THE MANGROVE OYSTER IN TRINIDAD WITH NOTES ON OTHER SHELLFISH RESOURCES,
University of the West Indies, St. Augustine (Trinidad). Dept. of Biological Sciences.
Peter R. Bacon.
Trop Sci. 12 (4): 265-278. 1970. Illus. Map.
Identifiers: Biology, Crab, Crassostrea-Rhizophorae, Cultivation, Fish, Gastropods, Mangrove, Oyster, Phyto, Plankton, Predators, Resources, Shellfish, Trinidad.

The mangrove oyster, Crassostrea rhizophorae, is an important commercial shellfish in Trinidad and other parts of the Caribbean, although little work has been done on the cultivation and exploitation of this species. In the Caroni Swamp, Trinidad, the present methods of harvesting natural stocks involve great loss of immature oysters and damage to the mangrove. The physical conditions appear suitable for rapid oyster growth and reproduction during most of the year, with small variations in temperature, available Ca and pH; with salinity between 0.4 to 3% a high standing crop of phytoplankton, strong tidal currents and a small vertical tidal range. Predators include fish, gastropods, and crabs, but do not cause such heavy losses as other organisms competing for space on the rhizophores. The oyster can be cultivated comparatively easily and cheaply using cut mangrove stakes. The open, shallow lagoons appear to be suitable areas for assembling the stakes. On the stakes the oysters reach marketable size in about 4 mo. so that up to 5 crops can be taken before the stakes need replacing. Removing newly settled spat and competing organisms from established oysters allows them to attain greater sizes. Inspection of the oysters and harvesting are easier with the stake cultivation than with the living mangrove rhizophores.--Copyright 1971, Biological Abstracts, Inc.
W72-05172

HYDROGRAPHIC NOTES ON SOME PERIPHERAL TRIBUTARIES OF THE LAGOON OF FUSARO, (IN ITALIAN),
Stazione Zoologica de Napoli (Italy).
M. Rigillo Troncone.
Pubbl Sta Zool Napoli. 37 (3): 405-414. 1969. Illus. English summary.
Identifiers: Fusaro, Hydrographic, Italy, Lagoon, Peripheral, Tributaries.

Physicochemical data on some peripheral freshwater tributaries of the brackish water lagoon of Fusaro are reported. Due to their sluggish flow, these tributaries do not seem to have a detectable influence on the salinity and fertility of the lagoon.--Copyright 1971, Biological Abstracts, Inc.
W72-05199

A STUDY ON THE BRACKISH WATER TYPE ON THE HAN RIVER ESTUARY (IN KOREAN),
Seoul National Univ. (Republic of Korea). Dept. of Botany.
Yung Ho Chung, and Jae Hyung Shim.
Korean J Bot. 12 (3): 35-42. 1969. Illus. Maps. English summary.
Identifiers: Brackish, Estuary, Frequency, Han, Phyto, Plankton, River.

The types of brackish region of the Han River Estuary with respect to its salinities and phytoplankton are studied. Geomorphologically, the Han River Estuary is the drowned river valley type. According to the Venice System, the estuarine extent is defined from the lower point of Jollyu-ri to Palmi Island. As a whole the estuarine region is mixo-haline including parts from oligohaline to poly-haline. In standpoint of phytoplankton frequency, the frequency of freshwater species is high in the upper region of estuary and that of marine species is high in the lower region. The rate of frequency of freshwater species is inversely proportional to that of marine species. The frequency of some typical brackish species is very low and almost similar in the whole region.--Copyright 1971, Biological Abstracts, Inc.
W72-05203

RESEARCH ON THE LEVEL OF CHLORINITY OF THE INTERSTITIAL WATER IN THE BED OF THE SLACK RIVER, (IN DUTCH),
Amsterdam Univ. (Netherlands). Inst. of Taxonomic Zoology.
K. Nooter, and F. Liebreghts.
Bujdr Dier. 41 (1): 23-30. 1971. Illus. Maps. English summary.
Identifiers: Bed, Chlorinity, France, Interstitial, River, Slack.

The supposition that the Slack, a river in northwestern France discharging directly into the sea, has a significantly higher chlorinity in its bottom sediments than in the overflowing river water, is confirmed. A device to take samples of sediment from the river bottom has been constructed and is described. To obtain the interstitial water, the sample is simply centrifuged. A peculiar phenomenon, which could not be explained, is that after a regular decrease of the interstitial chlorinities, a considerable increase (to > 1.5%) takes place at a distance of some 2 1/2 Km from the mouth. The interstitial chlorinity in the estuarine part of the river proved to be almost constant, regardless of the tidal cycle.--Copyright 1971, Biological Abstracts, Inc.
W72-05211

MOLLUSCA AND CLADOCERA OF THE 'VEN GORIGEMBERG', DYSTROPHIC MARSHES OF THE CAMPINE LIMBOURGEOISE,
Institut Royal des Sciences Naturelles de Belgique, Brussels.
E. Leloup, and S. Jacquemart.
Bull Inst Roy Sci Natur Belg. 46 (22): 1-16. 1970. Illus. Maps.
Identifiers: Belgium, Campine, Cladocera, Dystrophic, Gorigemberg, Limbourgeoise, Marshes, Mollusca, Vegetation.

The 'Ven Gorigemberg' lies 0.6 km northwest of Pontfort. The marsh occupies an isolated depression, surrounded by fixed dunes. A table of data as to the chemical composition of the water at different dates is given. The vegetation, in general, is described. Collection notes are given on 3 spp. of mollusks and 11 of Cladocera.--Copyright 1971, Biological Abstracts, Inc.
W72-05212

ECOLOGIC OBSERVATIONS ON AN ESTUARINE ENVIRONMENT AT FANNING ATOLL,
Hawaii Univ., Honolulu. Dept. of Zoology.
Eric B. Guinther.
Pac Sci 25 (2): 249-259. 1971. Illus. Maps.

Identifiers: Atoll, Ecologic, Environment, Estuarine, Fanning, Fauna, Oxygen, Pacific, Salinity, Temperature.

Salinity variations observed in an inlet and tidal flat on Fanning Atoll ranged from 7.8 to 42.3%. Water temperatures varied from 25.1 deg to 39.7 deg C. Daytime O2 concentrations indicated that water at all stations sampled was supersaturated. There are numerous inlets and tidal channels at Fanning and it is postulated that three conditions are important in producing and maintaining an estuarine environment in the inlets. These conditions are a restricted flow of water between the estuary and the lagoon, the association of extensive tidal flats with the inlet, and an intimate contact with the Ghyben-Herzberg lens of the surrounding island structure. Although distinct physical regions may be recognized within the estuaries, the distribution of organisms over these regions was not comparable from estuary to estuary. Most of the fauna of the estuarine environment on atolls appears to be derived from euryhaline, high intertidal, or supratidal species of the lagoon.--Copyright 1971, Biological Abstracts, Inc.
W72-05213

DISTRIBUTION AND ECOLOGY OF THE DECAPODA REPTANTIA OF THE ESTUARINE AREA OF THE RIVERS RHINE, MEUSE, AND SCHELDT,
Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).
W. J. Wolff, and A. J. J. Sandee.
Neth J Sea Res. 5 (2): 197-226. 1970. Illus. Map.
Identifiers: Carcinus-Maenas, Decapoda, Distribution, Ecology, Eriocheir-Sinensis, Estuarine, Meuse, Netherlands, Reptantia, Rhine, Rithropanopeus-Harrisii, Rivers, Scheldt.

The distribution and ecology of 24 spp. of Decapoda Reptantia in the estuarine part of the rivers Rhine, Meuse, and Scheldt, in the southwestern part of The Netherlands, is discussed. A few species are common offshore, but a larger number are abundant in the seaward reaches of the estuaries at salinities over 15% Cl. Below this value, only Carcinus maenas is abundant down to salinities of about 5% Cl. In still lower salinities the alien brackish-water species Rhithropanopeus harrisii and the similarly alien freshwater species Eriocheir sinensis occur. These 2 spp. apparently occupy niches that were empty before the present inhabitants were imported from abroad.--Copyright 1971, Biological Abstracts, Inc.
W72-05220

PHYTOPLANKTON AND HYDROGRAPHY OF THE BAY OF CADIZ IN 1969, (IN SPANISH),
Instituto de Investigaciones Pesqueras, Cadiz (Spain).
For primary bibliographic entry see Field 05A.
W72-05254

HYDROGRAPHIC RESEARCH STUDIES OF CORONA DEL LAGO FUSARO (NAPLES), (IN ITALIAN),
Naples Zoological Station (Italy).
Maria Rigillo Troncone.
Boll Pesca Piscicolt Idrobiol. 24 (2): 265-284. 1969. Illus. (English summary).
Identifiers: Algae, Corona-Del-Lago-Fusaro, Hydrographic, Invertebrates, Italy, Minerals, Naples, Oxygen, Temperature, Vertebrates.

Some pools at the peripheral southern side of the brackish lagoon of Fusaro are described, with some notes on their fauna and flora. These pools are irregularly connected with the lagoon on one side, and with seasonal freshwater flow of intermittent springs on the land side. Temperature is strictly related to air temperature. Salinity depends mostly on seasonal rhythm which is low in winter and high in summer, due to strong evaporation. Nitrites and phosphates were found in trace amounts. O2 distribution shows the most striking characteristics of these stations, due mostly to accumulation of huge masses of algae. Relative O2 concentrations are normally high, which explains the survival, even in extreme environmental conditions, of some species of invertebrates and vertebrates entering the pools from the lagoon at high tide and remaining trapped in them for a long time. pH is strictly related to O2 distribution.--Copyright 1971, Biological Abstracts, Inc.
W72-05255

EXPERIMENTAL STUDY OF THE FORMATION OF A POPULATION ON LOOSE GROUND FROM MEROPLANKTONIC LARVAE, (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
For primary bibliographic entry see Field 07B.
W72-05256

A CONTRIBUTION TO THE KNOWLEDGE OF REPRODUCTION IN THE OYSTER, CRASSOSTREA ANGULATA (LMK.), IN THE ESTUARY OF THE GUADALQUIVIR, (IN SPANISH),
Instituto de Investigaciones Pesqueras, Cadiz (Spain).
Emilio Pascual.
Invest Pesq. 34 (2): 477-498. 1970. Illus. English summary.
Identifiers: Crassostrea-Angulata, Estuary, Guadalquivir, Oyster, Reproduction, Setting, Spain, Spawning.

Seasonal gonadal changes and time of setting of C. angulata (Lmk.) were studied in the Guadalquivir estuary, South-Atlantic coast of Spain. Spawning and setting periods extend from July to Dec. In 1968 setting took place in 2 waves, in Aug and Nov-Dec, of which the latter was heavier, with water temperature varying between 16 and 18 deg C. In contrast, during 1969, the major setting took place in Sept. It seems that a drop in water temperature, down to 13 deg C, in the middle of Nov, caused the setting failure.--Copyright 1971, Biological Abstracts, Inc.
W72-05257

EXPERIMENTAL STUDIES ON ADAPTATION TO SALINITY SHOWN BY THE DIFFERENT RACES OF THE THREE-SPINED STICKLEBACK (GASTEROSTEUS ACULEATUS L.), (IN GERMAN),
Manfred Gutz.
Gesamten Hydrobiol. 55 (6): 845-894. 1970. (English summary).
Identifiers: Adaptation, Consumption, Gasterosteus-Aculeatus, Gasterosteus-Aculeatus-Leiurus, Gasterosteus-Aculeatus-Semiarmatus, Gasterosteus-Aculeatus-Trachurus, Oxygen, Races, Salinity, Stickleback, Three-Spined, Thyroid.

Three races of G. aculeatus were studied. The form trachurus lives in cold salt waters. Where larger rivers allow migration inland, this form undertakes a vernal anadromous spawning migration. The form leiurus is characteristic of fresh waters near the coast, though it penetrates far inland in large river systems. Sticklebacks of the form semiarmatus also are marine. All 3 forms are distinguishable morphologically. The 3 forms were studied in relation to their adaptation to salinity by measurement of the amino acid pool of the muscles and by their consumption of O2. No fundamental difference was observed between the forms trachurus and semiarmatus. Both adapted to seawater by increased active transport, as shown by their increased consumption of O2. The form leiurus adapted by increasing the amino acid pool, and showed no increased consumption of O2. During breeding, trachurus and semiarmatus performed the same as leiurus. The level of the amino acid pool was lowered by thyroxin and increased the O2-consumption. It also accelerated gonadal development. The forms trachurus and semiarmatus reach maturity about 4 wk earlier than leiurus suggesting that the thyroid activity of trachurus and semiarmatus is greater than that of leiurus.--Copyright 1971, Biological Abstracts, Inc.
W72-05259

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3B. Water Yield Improvement

DETECTION OF A CHANGE IN RUNOFF BY AN ANALYSIS OF DAILY FLOWS,
Department of Natural Resources, Quebec.
For primary bibliographic entry see Field 02A.
W-72 04846

ESTIMATED SUBSIDENCE IN THE RAYMOND BASIN, LOS ANGELES COUNTY, CALIFORNIA, FOR A POSTULATED WATER-LEVEL LOWERING, 1970-2020,
Geological Survey, Sacramento, Calif.
For primary bibliographic entry see Field 04B.
W72-04823

DEVELOPMENT OF COLD CLOUD SEEDING TECHNOLOGY FOR USE IN PRECIPITATION MANAGEMENT,
Utah State Univ., Logan. Coll. of Engineering.
C. F. Chappell, J. E. Fletcher, G. W. Reynolds, W. N. McNeil, and R. Campbell.
Available from NTIS, Springfield, Va. 22151 as PB-202 204-Price $3.00 paper copy. Utah Water Research Laboratory Report PRWG80-2 June 1971. 98 p, 63 fig, 12 tab, 6 ref. Bur. of Reclam Contract No 14-06-D-6820.

Descriptors: *Cloud seeding, *Weather modification, *Artificial precipitation, *Silver iodide, *Utah, Mountains, Cloud physics, Aircraft, Methodology, Meteorology, Data collections, Water yield, Instrumentation.
Identifiers: *Wasatch Mountains (Utah).

Airborne cloud seeding experiments were conducted for two winter seasons for increasing the water supply in the Wasatch Mountains in Utah. A positive seeding effect was accomplished within and on the periphery of the designated target area. Project designs, procedures, and problems encountered are summarized. Data processing, editing, analysis, procedures, and computer programs are described. Hydrologic and climatological support studies are presented. (Woodard-USGS)
W72-04836

HYDROMETEOROLOGY IN PRECIPITATION MANAGEMENT,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 06B.
W72-04866

A REVIEW OF INTER-REGIONAL AND INTERNATIONAL WATER TRANSFER PROPOSALS,
Western States Water Council, Portland, Oreg.
For primary bibliographic entry see Field 06B.
W72-04883

PARTIAL SOLUTIONS--THE OUTLOOK,
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 06B.
W72-04890

ALTERNATIVES IN WATER MANAGEMENT,
California Univ., Berkeley. Dept. of Sanitary Engineering.
For primary bibliographic entry see Field 06B.
W72-04893

COMMENTS ON THE CATCHMENT EXPERIMENT TO DETERMINE VEGETAL EFFECTS ON WATER YIELD,
Georgia Univ., Athens. School of Forest Resources.
John D. Hewlett.
Water Resour Bull 7 (2): 376-381, 1971.
Identifiers: Catchment, Determine, Vegetal, Water, Yield.

Managers and policy makers are forced to decide what combinations of vegetal cover and land use best favor water yield beofre the scientific community has fully agreed on some of the salient aspects o the problem. This has led to considerable confusion in the minds of land managers in many regions of the world and may continue to do so for some time. The catchment experiment remains the surest way to furnish each region with practical knowledge of local vegetation-water-yield relations.--Copyright 1971, Biological Abstracts, Inc.
W72-04954

EFFECT OF ELIMINATION OF VEGETATION ON STREAM WATER QUANTITY AND QUALITY,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
R. S. Pierce, J. W. Hornbeck, G. E. Likens, and F. H. Bormann.
IASH-UNESCO-Symposium on the Results of Research on Representative and Experimental Basins, Wellington (N.Z.), p 311-328, December 1970. 5 fig, 3 tab, 20 ref.

Descriptors: *Clear-cutting, *Herbicide treatment, *Water yield, *Water yield improvement, Hydrologic year, *Water chemistry, *Water quality, *Snow melt, Hydrologic equations, Ecosystem, Stream flow, Ion exchange, Water analysis, New Hampshire.
Identifiers: *Reducing evapotranspiration, *Streamflow yield, *Nutrient loss via stream, *Amount and timing, High flow, Hubbard Brook Experimental Forest (N H).

An experiment to determine the magnitude of possible increases of water yield and resultant changes in water quality was conducted at the Hubbard Brook Experimental Forest. The objectives were to determine the effect of vegetation removal on: (1) streamflow yields during summer low-flow periods; (2) the amount and timing of snowmelt runoff; and (3) the chemical relationships of the ecosystem and possible eutrophication of stream water. The forest of a watershed was cleared, no forest products removed, and herbicides applied to eliminate revegetation. The treatment resulted in changes in the hydrological, biological, and chemical behavior of the watershed: (1) snow melted sooner; (2) large-yield increases were obtained in the growing season, (a) streamflow increases ranged from 240 mm to 346 mm per water-year, (b) the greatest increases occurred in late summer, normally a period of critical low flows; (3) caused an increased loss of soil nutrients via streamflow, (a) nitrate concentrations increased by an average of 50 times, and (b) particulate matter increased 9 times. This study shows that when forest lands are treated by extreme methods of continued devegetation, serious problems could arise in regard to water quality and soil chemistry. (Reeves-Forest Service)
W72-05076

FOREST TRANSPIRATION REDUCTION BY CLEARCUTTING AND CHEMICAL TREATMENT,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02D.
W72-05077

WOODY PHREATOPHYTE INFESTATION OF THE MIDDLE BRAZOS RIVER FLOODPLAIN,
Utah State Univ., Logan. Dept. of Range Science.
Frank E. Busby, Jr., and Joseph L. Schuster.
J Range Manage. 24 (4): 285-287. 1971. Illus.
Identifiers: Brazos, Floodplain, Infestation, Mesquite-D, Middle, Phreatophyte, Prosopis-Glandulosa-D, River, Saltcedar-D, Tamarix-Gallica-D, Texas, Woody.

Sixty-four percent of the Brazos River floodplain upstream from Possum Kingdom Lake to the confluence of its Salt and Double Mountain forks (Texas) is occupied by woody phreatophytes. Saltcedar (Tamarix gallica) dominated communities are found on 36% and mesquite (Prosopis glandulosa) on 17%. Saltcedar acreage increased significantly from 1940 to 1969, but mesquite did not. At 1969 densities, these 2 spp. used approximately 51,000 acre feet of water annually along this expanse of the river.--Copyright 1971, Biological Abstracts, Inc.
W72-05231

3D. Conservation in Domestic and Municipal Use

THE SOCIAL CONTEXT OF URBAN PLANNING,
For primary bibliographic entry see Field 06B.
W72-04758

POPULATION GROWTH IN COMMUNITIES IN RELATION TO WATER RESOURCES POLICY.
Rivkin/Carson, Inc., Washington, D.C.
For primary bibliographic entry see Field 06B.
W72-04785

MUNICIPAL, INDUSTRIAL, AND IRRIGATION WATER USE IN WASHINGTON, 1970,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 06D.
W72-04816

WATER AND WESTERN DESTINY: FROM CONFLICT TO COOPERATION.
Colorado State Univ., Fort Collins. Environmental Resources Center.
For primary bibliographic entry see Field 06B.
W72-04878

A MODULAR DISTRIBUTED MODEL OF CATCHMENT DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 02E.
W72-04896

FORECASTING PLANNING,
Center for Environmental Studies, London (England).
For primary bibliographic entry see Field 06B.
W72-05082

URBAN SOCIAL THEORY AND RESEARCH,
Kent Univ., Canterbury (England). Faculty of Social Sciences.
For primary bibliographic entry see Field 06B.
W72-05121

PLANNING FOR PEOPLE, NOT BUILDINGS,
Harvard-MIT Joint Center for Urban Studies, Cambridge, Mass.
For primary bibliographic entry see Field 06B.
W72-05133

3E. Conservation in Industry

MUNICIPAL, INDUSTRIAL, AND IRRIGATION WATER USE IN WASHINGTON, 1970,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 06D.
W72-04816

THE REUSE OF WATER IN MANUFACTURING: AN EXPLANATORY ECONOMIC MODEL WITH DATA ANALYSIS,
New Mexico State Univ., University Park. Water Resources Research Inst.
F. L. Brown.
Available from the National Technical Information Service as PB-207 138, $3.00 in paper copy, $0.95 in microfiche. New Mexico Water Resources Research Institute, Completion Report, January 1972. 28 p, 2 fig, 1 tab, 14 ref. OWRR B-017-NMEX (1) and A-025-NMEX (1).

Descriptors: *Water reuse, Industrial water, *Recirculated water, Economics, Water demand, Effluents, Industrial wastes.
Identifiers: *Water reuse model, *Economic model, *Simultaneous equations model, Reusable water demand, Industrial water costs, Value-added, Industrial use.

An explanatory economic model is proposed for determination of water reuse rates based on the classical theory of the firm as a cost-minimizing institution. The firm's water behavior is conceptualized as consisting of a finite set of interdependence relationships with each relationship representing some specific segment of the entire operation. The individual relations were construed as jointly or simultaneously providing a theoretical representation of the entire ongoing manufacturing operation. Employing the simultaneous equations technique a set of four relations purporting to represent the water operations of the manufacturing firm was hypothesized. Two of these described the essential water characteristics of the manufacturing process itself; one was to simply identify that the water utilized in the manufacturing must come from one of two sources; and the last was a reusable water demand function. Implementation of the theoretical model empirically requires very detailed information on cost structures of manufacturing water use, such as complete knowledge of the cost function for all potential levels of operation. With projections of how these functions will change over or with changing conditions in the economic environment of the firm, it would be possible to predict withdrawal demands and reuse rates utilizing the model. (Creel-New Mexico State)
W72-05093

3F. Conservation in Agriculture

ANALYSIS OF COLOMBIAN PRECIPITATION TO ESTIMATE IRRIGATION REQUIREMENTS,
Utah State Univ., Logan. Coll. of Engineering.
For primary bibliographic entry see Field 02B.
W72-04806

MUNICIPAL, INDUSTRIAL, AND IRRIGATION WATER USE IN WASHINGTON, 1970,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 06D.
W72-04816

AGRICULTURAL FLOOD DAMAGE ASSESSMENT: A REVIEW AND INVESTIGATION OF A SIMULATION METHOD,
Toronto Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 06F.
W72-04877

WATER AND WESTERN DESTINY: FROM CONFLICT TO COOPERATION.
Colorado State Univ., Fort Collins. Environmental Resources Center.
For primary bibliographic entry see Field 06B.
W72-04878

WOBURN IRRIGATION, 1960-8: V. RESULTS FOR LEYS,
Rothamsted Experimental Station, Harpenden (England).

H. L. Penman.
J Agr Sci. 75 (1): 75-88. 1970. Illus.
Identifiers: Clover-D, England, Grass-D, Irrigation, Italian, Leys, Lucerne-D, Rye, Woburn, Yield.

Experiments were done on a sandy loam, using adequate fertilizer. Measurements were made of : crop yield (as total dry matter) when soil water content was kept near field capacity, the departure from field capacity (limiting deficit, D1) that produced no detectable change in yield, and responses to irrigation. Irrigation greatly helped the establishment of all 3 leys, and both Italian ryegrass and clover responded well to later irrigation. Lucerne did not. In English units, the limiting deficits, D1, for well-fertilized established crops were, approximately, 4 in for lucerne, 2 in for grass, and 1 in for clover.--Copyright 1971, Biological Abstracts, Inc.
W72-04910

WOBURN IRRIGATION, 1960-8: VI. RESULTS FOR ROTATION CROPS,
Rothamsted Experimental Station, Harpenden (England).
H. L. Penman.
J Agr Sci. 75 (1): 89-102. 1970. Illus.
Identifiers: Barley-M, Beans-D, Beet-D, Crops, Irrigation, Potatoes-D, Rotation, Sugar, Wheat-M, Woburn, Yield.

Experiments were done on a sandy loam, using adequate fertilizer. Measurements were made of: crop yield when soil water content was kept near field capacity, the departure from field capacity (limiting deficit, De) that produced no detectable change in yield, and responses to irrigation. Except for potatoes, all crops responded to irrigation as expected, with gains of 50-100% in the driest summers. In English units, the values of the limiting deficits were, approximately, up to 4 in by the end of Sept. for sugar beet, 1 in for early potatoes, 1 1/2 in for barley before ear emergence, 1 1/2 in for wheat before ear emergence and up to about 3 in 5 weeks later, and 1 1/2 in for beans.--Copyright 1971, Biological Abstracts, Inc.
W72-04911

GROWTH PATTERNS OF IRRIGATED SUGAR-BEET ROOTS AND TOPS,
Southwestern Great Plains Research Center, Bushland, Tex.
Wendell C. Johnson, and Ronald G. Davis.
Agron J. 63 (4): 649-652. 1971.
Identifiers: Beet-D, Beta-Vulgaris-D, Growth, Irrigated, Moisture, Patterns, Potentiometer, Roots, Stress, Sugar, Tops.

Electronic growth sensors were used in the field near Amarillo, Texas, to obtain continuous records on strip chart recorders of the root and top growth of irrigated sugarbeets (Beta vulgaris). The purpose of the study was to characterize the typical diurnal variation in growth rate of the crop and to determine its growth response to variations in ambient atmospheric and soil conditions. The growth sensors were potentiometers, either constructed in the form of slidewire discs or adapted from commercial linear transducers. The root sensors were operated by pulling action of a noose surrounding the root. The height sensors were rotating slidewire discs attached with fine wires to leaf tips. The growth patterns of sugarbeet roots and tops were very similar with most of the growth occurring at night. The main difference was a decrease in size of roots during the daytime that did not occur with leaves. On a typical day with few clouds in July or Aug. and with the plants under a moderate moisture stress, the growth rate of roots and tops accelerated suddenly about an hour before sunset and reached a peak or maximum point around sunset. Growth continued at a high rate during the night. The growth rate of roots usually reached a secondary peak between midnight and sunrise. The growth rate of roots and tops decreased rapidly after 7 to 8 a.m. and little or no growth took place during the middle of the day. The normal clear-day growth pattern was altered by high moisture stress as well as by cloudiness and rain showers.--Copyright 1971, Biological Abstracts, Inc.
W72-04915

BREEDING OF MAIZE FOR LOW RAINFALL AREAS OF KENYA: I. THE RELIABILITY OF YIELD OF EARLY AND LATER MATURING MAIZES,
National Vegetable Research Station, Wellesbourne (England).
B. D. Dowker.
J Agr Sci. 76 (3): 523-530. 1971. Illus.
Identifiers: Breeding, Earliness, Early, Kenya, Low, Maize-M, Maizes-M, Maturing, Rainfall, Yield.

A trial to compare the reliability of yield of a quick maturing maize (Taboran) with the medium maturity local maize was carried out at 2 low rainfall sites in Southern Province, Kenya, from 1957 to 1961. Each variety was grown at 2 spacings, giving plant densities of 1.8 and 3.6 pl/m sq. Results showed a consistent difference in 'days to 50% silking,' 'Taboran' being on average 17 days earlier than 'Local White.' There was no overall difference between varieties or spacings in yield per ha. There were highly significant interactions of seasons with varieties and with spacings. These were interpreted in terms of different linear yield/rainfall relationships for each variety and each spacing. A variety/spacing interaction was also demonstrated. Analysis of components of yield showed that similar linear relations between rainfall and each yield component obtained. There were significant differences between varieties and between spacings in both mean number of cobs per plant and yield per cob. 'Taboran' had a higher mean number of cobs per plant and 'Local White' a higher mean yield per cob. Seasons x varieties interactions were again interpreted in linear regression terms. Earliness of the 'Taboran' variety often enabled plants to produce silks before development was arrested by drought and so was responsible for its relatively high mean number of cobs per plant in low rainfall seasons, giving it an advantage over 'Local White' in yield per unit area in such circumstances. 'Taboran' was shown to have a potential value in local agriculture, because of its consistency of yield. The expected advantage or disadvantage of 'Taboran' over 'Local White' was calculated for an area of known rainfall from the respective yield/rainfall regressions and the seasonal rainfall probabilities. Selection for earliness was shown to be of basic importance in a breeding program for the low rainfall areas. Within a specified early maturity range, selection for yield improvement through the yield per cob component could be practiced. A maturity length similar to 'Taboran' would ensure a high value of mean cobs per plant in low rainfall season, i.e. confer the necessary reliability of yield.--Copyright 1971, Biological Abstracts, Inc.
W72-04916

EFFECT OF GYPSUM AND DROUGHT STRESSES ON MAIZE (ZEA MAYS L.): II. CONSUMPTIVE USE OF WATER,
Department of Agriculture of New South Wales, Leeton (Australia). Agricultural Research Station.
Lloyd A. Downey.
Agron J. 63 (4): 597-600. 1971. Illus.
Identifiers: Consumptive, Drought, Evapo, Gypsum, Maize-M, Stress, Transpiration, Turgidity, Water, Zea-Mays-M.

The effect of 3 defined periods of drought stress on the consumptive use of water by field grown maize (Zea mays L.) was measured using a complete water balance approach. Water status within the crop was defined by noon measurements of relative turgidity (RT). The treatments were set out in a randomized block design with a further comparison between the untreated (sodic) soil and the same soil treated with gypsum at 22.4 m tons ha-1. The components of the water balance--soil stored moisture, rain, and applied irrigation--were measured directly, and deep drainage was calculated from chloride redistribution. The no-stress treatment (RT at noon maintained > 90%) used 59 cm in evapotranspiration during the growing period. Drought stress (RT at noon < 90%) for a period of 20 days during male meiosis (early stress) reduced this total evapotranspiration to 44 cm, while drought stress during grain filling (late stress) reduced it to 51 cm. The application of gypsum had no significant effect on water use nor on water entry at irrigation. Application efficiency (total evapotranspiration/total applied water) was 86%, 79%, and 85% on the no-stress, early-stress, and late-stress treatments respectively. The balance (15 to 20%) of applied water was lost as deep drainage, indicating that results on more permeable soils would be inaccurate if this component were ignored. Maximum water use of 0.9 cm day-1 (or 0.8 of class 'A' pan) occurred during anthesis. This period was delayed 10 days by early stress. Water use efficiency was highest for the early stress-87 kg dry grain/cm water/ha and lowest for the late stress-26 kg.--Copyright 1971, Biological Abstracts, Inc.
W72-04917

SURVIVAL AND GROWTH OF COTTON PLANTS DAMAGED BY WINDBLOWN SAND,
Agricultural Research Service, Big Spring, Tex. Soil and Water Conservation Research Div.
D. W. Fryrear.
Agron J. 63 (4): 638-642. 1971.
Identifiers: Abrasive, Cotton-D, Damaged, Growth, Injury, Moisture, Plants, Sand, Stress, Survival, Windblown.

Cotton seedlings are easily damaged or destroyed by exposure to the abrasive action of windblown sand. The survival and recovery of damaged plants should be related to the moisture stress at the time of injury and the change in moisture stress following injury. Plants were grown in a greenhouse, exposed to windblown sand injury at 3 or 9 days of age, and returned to the greenhouse. The soil moisture content at exposure time was 7 (dry) or 11% (wet). The moisture content was constant or reversed at 3, 9, or 27 days after exposure. Cotton plant leaf area, height, and dry matter production (at 50 days of age), were significantly reduced by exposure to abrasive injury. Plant growth was delayed from 8 to 25 days, and the plants that recovered were shorter but had more leaf area per unit of height than plants not exposed. Plant survival for 3-day-old plants abraded with blowing sand was 62 and 65% for a soil at 7 (dry) and 11% (wet) moisture, respectively. Plant survival for 9-day-old plants exposed to abrasive injury was 78 and 63% for the dry and wet soil respectively. Decreasing the soil moisture content of a wet soil 9 or 27 days after 3-day-old plants were exposed significantly decreased survival. When 9-day-old plants in a dry soil were exposed, increasing the soil moisture 3 days after exposure significantly decreased survival, but decreasing the soil moisture of a wet soil 9 or 27 days after exposure significantly increased plant survival. Plant tissue destruction was observed as the leaves and hypocotyl became dark green or black. Thin sections of the tissue revealed a compression of the damaged cells rather than an actual abrading away of the plant material.--Copyright 1971, Biological Abstracts, Inc.
W72-04918

THE EFFECT OF RELATIVE HUMIDITY ON GROWTH, YIELD, AND WATER CONSUMPTION OF BEAN PLANTS,
Arizona Univ., Tucson. Environmental Research Lab.
James W. O'Leary, and George N. Knect.
J Amer Soc Hort Sci. 96 (3): 263-265. 1971.
Identifiers: Bean-D, Consumption, Growth, Humidity, Phaseolus-Vulgaris-D, Plants, Water, Yield.

Red kidney bean (Phaseolus vulgaris L.) plants were grown continuously under 35-40%, 70-75%, or 95w100% relative humidity (RH) in growth chambers. There were no significant differences in fresh or dry weight of plants after 20 or 26 days' growth in the chambers. Water consumption was significantly lowered by the highest humidity, and the dry weight produced/unit of water consumed was significantly greater in those plants grown at 95-100% RH. After 47 days at the stated humidity levels, no significant differences were found in fresh or dry weight of the fruits. The only significant difference in seed dry weight was between the lowest and the medium humidity. The yield in the low humidity was 60% of that in the medium humidity. Thus, there are no significant reductions in either growth or yield of bean plants by continuous growth at near saturation RH.--Copyright 1971, Biological Abstracts, Inc.
W72-04926

WATER STRESS AND STEM RADIAL CONTRACTION OF COTTON PLANTS (GOSSYPIUM HIRSUTUM L.) UNDER FIELD CONDITIONS,
Agricultural Research Service, Weslaco, Tex. Soil and Water Conservation Research Div.
L. N. Namken, J. F. Bartholic, and J. R. Runkles.
Agron J 63 (4): 623-627, 1971.
Identifiers: Contraction, Cotton-D, Displacement, Field, Gossypium-Hirsutum-D, Growth, Linear, Plants, Radial, Stem, Stress, Transducers, Under, Variable, Water.

Radial contraction and expansion of cotton plant stems (Gossypium hirsutum L.) were monitored with linear variable displacement transducers throughout the 1969 and 1970 growing seasons under field conditions. Relative water content and water potential measurements of the leaves were routinely made as indices of water stress of the cotton plant for comparison with stem contraction measurements. The amount of stem radial contraction was directly related to the water-stress indices of the cotton plant. Stem contraction was more sensitive to plant water stress as stress increased. No contraction occurred until relative water contents were below 79 or 83%, depending on stage of plant growth, or until leaf water potentials were lower than -8.0 bars. The relation between relative water content and stem contraction was influenced by stage of plant growth. A higher degree of plant water stress was required to provide an equivalent radial change during the late bloom and boll development period when negative growth rates were low. Stage of plant growth did not affect the relation between leaf water potential and radial stem contraction. Leaf water potential recovered more rapidly than cotton stem contraction. However, the relation was well defined for the desorption phase of the stress cycle from minimum stress in early morning (0600 hr) to maximum stress at about 1400 hr.--Copyright 1971, Biological Abstracts, Inc.
W72-04961

EVALUATING MULTIPLE ECONOMIC EFFECTS OF FORAGE DEVELOPMENT AND MANAGEMENT,
Soil Conservation Service, Portland, Oreg.
For primary bibliographic entry see Field 04A.
W72-05104

REFLECTANCE AND INTERNAL STRUCTURE OF COTTON LEAVES, GOSSYPIUM HIRSUTUM L.,
Department of Agriculture, Weslaco, Tex.
H. W. Gausman, W. A. Allen, V. I. Myers, and R. Cardenas.
Agron J. 61 (3): 374-376. 1969. Illus.
Identifiers: Arrangement, Cell, Cotton-D, Gossypium-Hirsutum-D, Internal, Leaves, Osmotic, Reflectance, Spectroscopy, Stress, Structure.

Cotton (Gossypium hirsutum) plants were grown hydroponically in a controlled environment. NaCl was used to induce 3 osmotic stresses: low (0 atm), medium (6 atm), and high (12 atm). Leaves of approximately the same age were harvested 49 days after planting from 5 replications of each treatment, and their reflectance and transmittance spectra were obtained for the wavelength interval 500- to 2500-microgram. Osmotic stresses of 6 and 12 atm reduced reflectance and increased transmittance of near-IR light (750-1350 microgram) as compared with leaves from plants grown with low osmotic stress. Tissue sections from the same leaves were processed to provide transverse sections for histological examination; leaves from plants grown with 6 and 12 atm of osmotic stress exhibited a more compact cell arrangement than nonosmotically stressed leaves.--Copyright 1971, Biological Abstracts, Inc.
W72-05105

SOME FURTHER OBSERVATIONS ON PROTEIN FRACTIONS ISOLATED FROM WHEAT LEAVES SUBJECTED TO MOISTURE STRESS,
Oklahoma State Univ., Stillwater. Dept. of Botany.
Glenn W. Todd, Patsy Vick, and Sing-Dao Tsai.
Proc Okla Acad Sci. 50: 106-109. 1970. Illus.
Identifiers: Amino-Acids, Fractions, Isolated, Leaves, Moisture, Nucleotides, Peptides, Protein, Stress, Subjected, Wheat-M.

The soluble protein fraction from wheat leaves can be separated on agarose Bio-gel A5m into 2 major fractions, one of very high molecular weight (probably exceeding 1 x 106) and the second of 150,000-250,000. The 2nd fraction decreased markedly with drought stress, while the 1st fraction increased, especially after recovery from drought. A small molecular weight fraction which was further fractionated on Sephadex G-25 in increased droughted plants and consisted of free amino acids and probably nucleotides. It appears that the proteins in drought-stressed leaves are degraded to amino acids. No significant quantity of small peptides accumulated.--Copyright 1971, Biological Abstracts, Inc.
W72-05106

A STUDY OF THE INFLUENCE OF NITROGEN AND PHOSPHORUS FERTILIZERS ON THE CORN GROWN ON THE ALLUVIAL SOILS OF THE DANUBE FLOODED AREA,
Institutul Agronomic, Bucharest (Rumania).
For primary bibliographic entry see Field 02G.
W72-05116

ANNUAL SOIL MOISTURE-TEMPERATURE PATTERNS AS INFLUENCED BY IRRIGATION,
Forest Service (USDA), Syracuse, N.Y.
For primary bibliographic entry see Field 02G.
W72-05137

ANATOMICAL CHANGES IN THE SHOOT TIP OF WHEAT AFTER EXPOSURE TO DROUGHT STRESS,
Morgan State Coll., Baltimore, Md. Dept. of Biology.
Esther J. Ridley, and Glenn W. Todd.
Crop Sci. 11 (4): 471-474. 1971. Illus.
Identifiers: Anatomical, Apical, Drought, Exposure, Meristem, Shoot, Stress, Tip, Triticum-Aestivum-M, Wheat-M.

Shoot apices of 3 to 4-week-old winter wheat (Triticum aestivum aestivum L.) seedlings of cultivars 'Ponca' and 'Cheyenne' were examined and described anatomically before and after exposure to drought stress. Drought caused the following changes: thickend cell walls in apical and sub-apical regions, abundant peri-and anti-clinal divisions with granulation and absence of protoplasts of some cells in the sub-apical region, plasmolysis of some cells, lack of distinct zonation, and increased lateral bud formation. Apex length in both cultivars was comparable in controls but length more than doubled in 'Cheyenne' with drought stress while drought-susceptible 'Ponca' changed very little. The distance between the apex tip and the lst differentiated procambial cells was greatest in control 'Cheyenne' and decreased with drought to less than half in plants droughted 8 days. This distance to procambium decreased in 'Ponca' with slight drought, then increased with additional drought stress. It is suggested that several of these changes may be responsible for the eventual death of the plant from severe drought.--Copyright 1971, Biological Abstracts, Inc.
W72-05153

A STUDY OF THE VARIATION OF WATER LEVEL AND MINERALIZATION OF THE GROUND WATER IN THE DANUBE DRAINAGE AREA 'BOIANU-STICLENAU' (IN RUMANIAN),
Institutul Agronomic, Bucharest (Rumania).
For primary bibliographic entry see Field 05C.
W72-05169

INFLUENCE OF SOIL MOISTURE AND SUBMERGENCE OF RICE FIELDS ON EMERGENCE AND INITIAL DEVELOPMENT OF RICE (IN BULGARIAN),
D. Draganov, V. Vasilev, G. Staridolsky, and I. Chilikov.
Rastenievod Nauki. 8 (1): 71-78. Illus. 1971. English summary.
Identifiers: Development, Emergence, Fields, Growth, Moisture, Rice-M, Root, Soil, Stem, Submergence.

It is not necessary to maintain the field continuously submerged during rice emergence, growth of the primary leaf and initial development of the young plants. Following seed swelling, which terminates in 3-4 days, the water in the rice field should be drained and the soil moisture maintained to field capacity in case of surface sowing and to 80% of the field capacity in sowing to 2 cm. The initial growth of young plants is more intensive at lower soil moisture and without submergence. The growth rate of the primary leaf is greatest at moisture 80% of field capacity. Young plants have longer stems and shorter roots when submerged with 5 cm of water. The stem length is less but the weight of the plants is higher when grown without submergence. These plants remain shorter to the 23rd day, but they are more vigorous and have a better root system. Weight of plants grown at soil moisture of 80% of field capacity is 30% higher on the 18th day and 50% on the 23rd day than that of plants grown at field capacity.--Copyright 1971, Biological Abstracts, Inc.
W72-05171

MICROFERTILIZING WITH MO OF IRRIGATED ALFALFA GROWN ON CINNAMON FOREST SOIL IN SOUTH BULGARIA (IN BULGARIAN),
Academy of Agricultural Sciences, Stara Zagora (Bulgaria). Experiment Station of Irrigated Agriculture.
G. Hristov.
Rastenievod Nauki. 8 (1): 29-36. 1971. English summary.
Identifiers: Alfalfa-D, Bulgaria, Cinnamon, Fertilizing, Forest, Grown, Growth, Irrigated, Micro, Molybdenum, Protein, Soil, South, Yield.

Leached cinnamon forest soil responded well to Mo. Mo produced dark green coloration and more robust growth. Yields and crude protein content of alfalfa hay were increased. A semi-wet treatment of alfalfa seed with 10 mg Mo/0.10 ha was best. Application as a single foliar nutrition (leaf spray) of the young alfalfa plants was almost as good.--Copyright 1971, Biological Abstracts, Inc.
W72-05174

RESULTS OF COMPLEX INVESTIGATIONS RELATING TO THE INFLUENCE OF SOIL MOISTURE, FERTILIZING WITH N, SOWING DENSITY AND YEAR, SINGLY AND INTERACTING, IN WHEAT PRODUCTION (IN CROATIAN),
Zagreb Univ. (Yugoslovia). Faculty of Agriculture.
Josip Potocanac.
Arh Poljopr Nauk. 23 (82): 3-17. 1970. English summary.
Identifiers: Complex, Density, Fertilizing, Interacting, Moisture, Nitrogen, Production, Relating, Singly, Soil, Sowing, Wheat-M, Year, Yugoslavia.

'Leonardo' wheat was studied in a complex split-plot trial. Top dressing with N had the greatest influence. The 2nd most important factor was the year. The influence of sowing density and soil moisture was very small. Sufficient quantity and good distribution of rainfall is characteristic of the area. Interactions upon the yield were shown by the following combinations: soil moisture x top dressing with N, top dressing with N x year and soil moisture x top dressing with N x year. Good yields were obtained with dressing with 100 kg/ha of pure N, sowing 600 grains/m2 and soil moisture in the vegetation period from shooting to ripening equal to 70-85%, or dressing with 140 kg/ha of pure N, sowing 450-600 grains per 1 m2.--Copyright 1971, Biological Abstracts, Inc.
W72-05177

EFFECTS OF SOIL MOISTURE STRESS ON TWO VARIETIES OF UPLAND COTTON IN ISRAEL: I. THE COASTAL PLAIN REGION,
Hebrew Univ., Rehovoth (Israel). Faculty of Agriculture.
A. Marani, and A. Amirav.
Exp Agric. 7 (3): 213-224. 1971. Illus.

Descriptors: Boll, Coastal, Cotton-D, Development, Flowering, Irrigation, Israel, Lint, Moisture, Plain, Soil, Stress, Upland, Varieties, Yield.

Effects of moisture stress during different stages of cotton development were examined in 2 experiments when temperatures were mild and evapotranspiration less than 6 mm./day. Two varieties of upland cotton, Acala 4-42 and Deltapine Smoothleaf, were affected similarly. Moisture stress at the beginning of flowering reduced growth rate and the numbers of flowers and bolls. During the 2nd half of the flowering period it reduced the percentage of boll retention, boll number, boll weight, seed index, lint index, and lint length. Stress during boll development had similar effects and caused earlier maturity. Lint yield was reduced significantly by moisture stress during each of the periods but tensile strength of lint was not affected. The irrigations, if properly timed so that no appreciable moisture stress occurred, were sufficient for high yields and good quality of lint, and the first could be postponed until after flowering began without any loss in yield. (See also W72-05180)--Copyright 1971, Biological Abstracts, Inc.
W72-05179

EFFECTS OF SOIL MOISTURE STRESS ON TWO VARIETIES OF UPLAND COTTON IN ISRAEL: II. THE NORTHERN NEGEV REGION,
Volcani Inst. of Agriculture Research, Bet-Dagan (Israel).
D. Shimshi, and A. Marani.
Exp Agric. 7 (3): 225-239. 1971. Illus.
Identifiers: Aperture, Boll, Cotton-D, Development, Flowering, Index, Irrigation, Israel, Leaf, Length, Lint, Moisture, Negev, Northern, Refractive, Sap, Soil, Stomatal, Strength, Stress, Upland, Varieties, Yield.

The effects of moisture stress at various stages of development were studied on 2 varieties of cotton in the arid Negev region of Israel. Experiments over 2 yr indicated that the stage at which moisture stress occurred determined its effect: when at the beginning of flowering, yield was considerably reduced; at the peak of flowering there was a less pronounced effect; and when stress occurred during boll development it had an effect in only one year, when reserves of moisture in the deep soil layers were low. Lint yield ranged from 380 kg./ha. without irrigation to 2150 kb./ha. with 5 irrigations. Effects on lint length and lint strength were also studied. Two physiological indices, stomatal aperture and refractive index of leaf sat, were used to determine the onset of moisture stress. (See also W72-05179)--Copyright 1971, Biological Abstracts, Inc.
W72-05180

DREDGE-TAILING AGRICULTURE ON THE RIO NECHI, COLOMBIA,
California Univ., Davis. Dept. of Geography.
Roy J. Shlemon, and L. Barry Phelps.
Geogr Rev. 61 (3): 396-414. 1971. Illus.
Identifiers: Agriculture, Colombia, Dredge-Tailing, Nechi, Rio.

In the last 2 decades dredge tailings, the waste product of alluvial mining, have become islands of intensive agriculture in a generally unproductive tropical forest along the Rio Nechi. The clay tailings are fertile agricultural ground surrounded by sterile leached terraces, thin upland soils, and the inherently dangerous flood plain. They are astride the main communications artery, the Rio Nechi, are seldom flooded, and contain sufficient gravel to provide a natural mulch for suppressing weed growth.--Copyright 1971, Biological A Abstracts, Inc.
W72-05182

SPECIAL METEOROLOGICAL DATA NEEDS FOR AGRICULTURE,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 02B.
W72-05183

AGRICULTURAL RESEARCH: PROGRESS, PROBLEMS AND PROSPECTS,
Indian Agricultural Research Inst., New Delhi.
M. S. Swaminathan.
J Bombay Natur Hist Soc. 67 (3): 466-480. 1970. Illus.
Identifiers: Agricultural, Breeding, Cereal, Fertilizer, Genetics, Legume-D, Machinery, Pesticides, Rotation.

The selection of plants suitable for domestication from the extensive wild flora and their subsequent improvement through conscious or unconscious breeding, the conversion of geological deposits into soils and planned efforts to conserve and provide water to crops have been the major components of progress until the 17th century. The next significant advance came with the introduction of cereal-legume rotations and addition of nutrients in the form of fertilizers. The beginning of this century marked the re-discovery of Mendel's laws of inheritence and the use of the principles of genetics in the tailoring of plants adapted to the changing physico-chemical, biological, technological, economic and social components of the environment. This development in turn triggered rapid progress in industrial activity related to agriculture, particularly those relating to fertilizers, pesticides and other agricultural chemicals, machinery and post-harvest technology. A few of the significant landmarks of this recent evolutionary phase of Jari are indicated.--Copyright 1971, Biological Abstracts, Inc.
W72-05184

RELATIONS BETWEEN WATER STATUS, LEAF TEMPERATURE STOMATAL APERTURE, AND PRODUCTIVITY OF SOME WHEAT VARIETIES (IN GERMAN),
Canada Agricultural Research Station, Saskatoon (Saskatchewan).
R. Kaul, and W. L. Crowle.
Z Pflanzenzuecht. 65 (3): 233-243. 1971. Illus. English summary.
Identifiers: Aperture, Desiccation, Leaf, Productivity, Relations, Stomatal, Temperature, Tolerance, Transpiration, Varieties, Water, Wheat.

The water potentials, leaf temperatures, and stomatal apertures of spring wheat varieties were measured under semiarid field cultivation. Water potentials decreased over the season, with slight differences between varieties, but no correlation appeared with yields. Leaf temperatures, depending on the day, stayed 2-5C above air temperature. Apparently the transpiration rates of the varieties were identical. Stomates closed when water potentials decreased, although those of some varieties closed later than others. Productivity, however, was not uniformly associated with stomatal aperture. The relationship of desiccation tolerance to productivity is discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-05185

ADVECTION AND EVAPOTRANSPIRATION OF WIDE-ROW SORGHUM IN THE CENTRAL GREAT PLAINS,
Utah State Univ., Logan. Dept. of Soils and Meteorology.
For primary bibliographic entry see Field 02D.
W72-05186

THE VARIABILITY OF SEEDLING DROUGHT TOLERANCE IN SOME COCKSFOOT (DACTYLIS GLOMERATA L.) VARIETIES, (IN RUMANIAN),
Agricultural Research Council, Aberystwyth (Wales). Welsh Plant Breeding Station.
E. Kellner, and B. Tyler.
Inst Cercet Pentru Cereale Plante Teh Fundulea Sect Amelior Plant Prob Genet Teo Apl. 2 (1): 62-71. 1970. Illus. English summary.
Identifiers: Age, Cocksfoot-M, Drought, Origin, Seedling, Survival, Tolerance, Variability, Varieties.

Drought tolerance of 10, 20 and 30 day old seedlings was tested in 6 varieties of different geographic origin. There were significant differences in seedling vigor: the most vigorous was the Romanian Banat and the least vigorous a diploid ecotype from Portugal. After a drought treatment of 20 days, seedling survival was 100% for all seedling ages. After 31 days of drought 79-85% of the 10 day old plants, 26-57% of the 20 day old plants, and 31-52% of the 30 day old plants survived. There was a significant interaction between varieties and rates of survival at different seedling ages. Seedling drought tolerance was influenced by the origin of the tested varieties.--Copyright 1971, Biological Abstracts, Inc.
W72-05187

EFFECT OF GYPSUM AND DROUGHT STRESS ON MAIZE (ZEA MAYS L.): I. GROWTH, LIGHT ABSORPTION AND YIELD,
Agricultural Research Station, Leeton (Australia).
Lloyd A. Downey.
Agron J. 63 (4): 569-572. 1971.
Identifiers: Adsorption, Development, Drought, Grain, Growth, Gypsum, Light, Maize-M, Stress, Tillering, Turgidity, Yield, Zea-Mays-M.

An experiment was designed to study the effect of gypsum and drought stress on growth, water status and yield with maize (Zea mays L.). Water status was assessed under field conditions by measurements of relative turgidity (RT) at noon. No stress was defined as RT greater than 90%, drought stress as RT less than 90%. A no-stress crop was compared with a crop drought stressed for a

period of 20 days during male meiosis and with a crop drought stressed during grain filling (after pollination to maturity). These treatments were set out in a randomized block design with a further comparison between the untreated sodic clay soil (control) and the same soil treated with gypsum. Gypsum and no-stress conditions stimulated tiller production so that the final effective plant densities were above optimum. The no-stress treatments produced large amounts of dry matter but this was channelled into sterile tillers rather than into grain. Drought stress during male meiosis stunted growth, stunted tassel development, reduced chlorophyll content and light adsorption (during the period of stress) but, overall, was not very detrimental to grain yield. Drought stress during grain filling reduced grain yield by 50%; grain weight was reduced and a very high proportion of photosynthate went into sterile tillers.--Copyright 1971, Biological Abstracts, Inc.
W72-05188

EFFECTS OF DEPTH OF SUBMERGENCE, FERTILIZATION AND CULTIVATION ON WATER REQUIREMENT AND YIELD OF RICE,
Indian Inst. of Tech., Kharagpur.
H. K. Pande, and B. N. Mittra.
Exp Agric. 7 (3): 241-248. 1971. Illus.
Identifiers: Compaction, Cultivation, Depth, Evaporation, Fertilization, Percolation, Puddling, Rice-M, Soil, Submergence, Transpiration, Yield.

Under the 3 levels of submergence (0, 5 and 10 cm. depths), water requirement of rice was maximum at 10 cm. but crop performance was similar to that at 5 cm. With medium and high levels of fertilization the crop had a higher water requirement than under low level, for aus and aman crops. Compacted soil compared well with puddled soil, but water requirement was appreciably higher with shallow puddling. Water requirement, transpiration, evaporation and percolation losses were greater under submergence, and only transpiration was greater under higher levels of fertilization. Transpiration was maximum at flowering stage.--Copyright 1971, Biological Abstracts, Inc.
W72-05190

THE INFLUENCE OF SOIL MOISTURE ON PHOSPHORUS UPTAKE BY CORN AND ON THE EFFICIENCY OF ADDED SUPERPHOSPHATE,
Ain Shams Univ., Cairo (Egypt). Dept. of Soils.
Fayez M. Abdou, S. Y. Metwally, H. Hamdi, and M. El Nennah.
UAR J Soil Sci. 9 (2): 175-183. 1969.
Identifiers: Corn-M, Moisture, Phosphate, Phosphorus, Soil, Uptake.

Dry matter, P uptake, and the fraction of P derived from superphosphate increased with increasing soil moisture. Reducing soil moisture had a greater effect on the absorption of P from the fertilizer than from the soil. Plants can absorb small, but measurable amounts of P from air dry soil, or from soils with less than the wilting percentage of moisture, provided that part of the root system can take water from another site.--Copyright 1971, Biological Abstracts, Inc.
W72-05217

STAND PATTERNS FOR ALFALFA-GRASS HAY PRODUCTION IN A DRY CLIMATE,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
M. R. Kilcher, and D. H. Heinrichs.
Can J Plant Sci. 51 (4): 317-322. 1971. Illus.
Identifiers: Agropyron-Cristatum-M, Agropyron-Desertorum-M, Agropyron-Intermedium-M, Alfalfa-D, Bromus-Inermis-M, Climate, Dry, Grass-M, Hay, Medicago-Media-D, Patterns, Production, Row, Spacing, Stand.

Agropyron cristatum cv. 'Fairway,' A. desertorum cv. 'Summit,' A. intermedium cv. 'Chief,' and Bromus inermis cv. 'Carlton' were assessed for hay production when growing with Medicago media cv. 'Rambler' in various stand patterns (mixed, cross rows and alternate rows) and various row spacings (30, 60 and 90 cm). The highest production over a 5-yr-period occurred at 60-cm row spacings, when the seeding pattern was either cross or alternate. These 2 patterns isolated the alfalfa from the grass and resulted in an increased yield contribution from the legume. Regardless of the grass species used, the production response of the alfalfa to stand patterns was similar.--Copyright 1971, Biological Abstracts, Inc.
W72-05223

EFFECT OF 2-CHLORO-ETHYLTRIMETHYL--AMMONIUM CHLORIDE (CCC) AND UREA ON SHEDDING OF YOUNG BOLLS AND YIELD OF COTTON PLANTS UNDER FREQUENT AND INFREQUENT IRRIGATION,
Ministry of Agriculture, Cairo (Egypt).
H. Hamawi.
Uar J Soil Sci. 9 (2): 215-223. 1969 (1970).
Identifiers: Ammonium, Bolls, Chloride, Chloroethyltrimethyl, Cotton-D, Drought, Infrequent, Irrigation, Plants, Resistance, Shedding, Under, Urea, Yield, Young.

Under frequent irrigation, spraying cotton plants with 4% urea at the beginning of flower bud initiation significantly increased the number of flowers produced per plant, number of harvested bolls, and yield of seed cotton per plant. Under frequent irrigation, spraying cotton plants with both CCC plus urea showed some increase in the number of flowers produced per plant but increased the shedding percentage and there was no significant effect on both number of harvested bolls and yield. Under the same irrigation conditions, spraying cotton plants with CCC alone did not affect the number of flowers produced per plant, increased the shedding percentage and significantly reduced the number of harvested bolls and yield. Under infrequent irrigation spraying cotton plants with CCC alone or CCC plus urea increased the number of flowers produced per plant but the shedding percentage increased much more than any other treatment and the number of harvested bolls and yields decreased significantly. CCC has no effect on the resistance of cotton plants exposed to drought.--Copyright 1971, Biological Abstracts, Inc.
W72-05229

EFFECT OF GROWTH REGULATOR AND ANTI-TRANSPIRANT CHEMICALS ON WATER REQUIREMENT AND GROWTH COMPONENTS OF ALFALFA (MEDICAGO SATIVA L.),
Agricultural Research Service, Beltsville, Md. Field Crops and Animal Products Research Branch.
D. F. Cole, A. K. Dorrenz, and M. A. Massengale.
Crop Sci. 11 (4): 582-584. 1971. Illus.
Identifiers: Acetate, Alfalfa-D, Ammonium, Branching, Chemicals, Chloride, Chloroethyltrimethyl, Components, Dodecenyl, Forage, Gibberellic-Acid, Growth, IAA, Medicago-Sativa-D, Mercuric, Phenyl, Regulator, Succinic-Acid, Transpirant, Yield.

Plants of Medicago sativa L. cv. 'Mesa-Sirsa' were grown in both the greenhouse and controlled environmental growth chambers and used to evaluate the effect of various antitranspirant and growth regulator chemicals on water requirement and growth components. Gibberellic acid (GA) significantly lowered the water requirement of alfalfa in all environments. IAA, (2-chloroethyl) trimethylammonium chloride (CCC), phenyl-mercuric acetate (PMA), and dodecenylsuccinic acid (DSA) did not alter the water requirement of alfalfa. The antitranspirant chemicals did not reduce the amount of water transpired, and further DSA caused plant damage when used as a foliar spray. Gibberellic acid significantly increased the amount of stem tissue produced in all environments, which resulted in more total dry-forage yield. Gibberellic acid had no effect on the amount of leaflet tissue produced except in experiments where GA stimulated secondary branching.--Copyright 1971, Biological Abstract, Inc.
W72-05232

HERBICIDES IN NARROW-ROW COTTON CULTURE,
Southwestern Great Plains Research Center, Bushland, Tex.
A. F. Wiese, and D. T. Smith.
Crop Sci. 11 (4): 518-520. 1971. Illus.
Identifiers: Alachlor, Amaranthus-D, Cotton-D, Culture, Di, Diuron, Fluometuron, Gossypium-Hirsutum-D, Herbicides, Methyl, Nitralin, Norea, Pigweed-D, Prometryne, Row, Terephthalate, Tetrachloro, Trifluralin.

On loamy sand soil application of several preemergence herbicides (DCPA dimethyl/tetrachloroterephthalate, trifluralin, diuron, norea, prometryne, nitralin, alachlor, fluometuron) followed by sprinkle irrigation or rainfall resulted in good control of a mixture of several Amaranthus (pigweed) species in narrow-row (18 to 25 cm) cotton (Gossypium hirsutum L.) without causing crop injury. On fine, sandy loam soil preplant herbicide applications, followed by incorporation with a spike-toothed harrow, gave good weed control without cotton injury. Deep incorporation of preplant herbicides on the fine sandy loam caused cotton injury. On loam soil, shallow incorporation with a grain drill during the planting operation or deeper incorporation with a tandem disk gave good pigweed control without cotton injury. Herbicide rates required for control of pigweed in narrow-row cotton were comparable to those required for weed control in conventional cultivated cotton on the same soil types.--Copyright 1971, Biological Abstracts, Inc.
W72-05233

PLANT WATER POTENTIAL GRADIENTS MEASURED IN THE FIELD BY FREEZING POINT,
Agricultural Research Service, Kimberly, Idaho. Snake River Research Center.
J. W. Cary, and H. D. Fisher.
Physiol Plan. 24 (3): 397-402. 1971. Illus.
Identifiers: Alfalfa-D, Bean-D, Beet-D, Beta-Vulgaris-D, Corn-M, Cucurbita-Pepo-D, Elements, Evapo, Field, Fluid, Freezing, Gradients, Guttation, Helianthus-Annuus-D, Leaf, Measured, Medicago-Sativa-D, Phaseolus-Vulgaris-D, Plant, Point, Potato-D, Potential, Pumpkin-D, Root, Soil, Solanum-Tuberosum-D, Sugar, Sunflower-D, Tissue, Transpiration, Triticum-Aestivum-M, Wheat-M, Xylem, Zea-Mays-M, Zone.

A portable freezing point meter was used in the field to measure the water potential gradients in sunflower (Helianthus annuus), beans (Phaseolus vulgaris), corn (Zea mays), wheat (Triticum aestivum), pumpkin (Cucurbita pepo), potato (Solanum tuberosum), alfalfa (Medicago sativa), and sugarbeets (Beta vulgaris). The measurements were made between daybreak and sunrise, and again during the middle of the afternoon on days when the potential evapotranspiration varied between 6.5 and 8.0 mm of water. The gradients varied from a maximum of 0.2 bar/cm in wheat, down to an undetectable value for pumpkin. Although most of the soil in the root zone was kept at potentials above -1 bar, the bulk of the root tissue had winter potentials of -5 to -10 bars. Differences in water potential between shaded and unshaded leaves, and between leaf tissue and guttation fluid suggested a similar drop of several bars between xylem elements and the surrounding leaf tissue in some plant species. The implications of such drops are discussed with respect to plant water transport equations and pressure cell potential measurements.--Copyright 1971, Biological Abstracts, Inc.
W72-05239

INTERACTION OF WATER UPTAKE AND ROOT DISTRIBUTION,
Auburn Univ., Ala. Dept. of Civil Engineering.
Fred J. Molz.
Agron J. 63 (4): 608-610. 1971.
Identifiers: Distribution, Interaction, Permeability, Root, Sorghum-M, Uptake.

A simplified version of a mathematical model developed by Molz and Remson (1970) is used to compute effective root distribution for sorghum. Data from an experiment by Gardner (1964) are utilized in the computation, and the computed root distribution is compared with the measured distribution. The effective distribution is computed for 1, 3, 5, and 7 days after the beginning of the experiment, and results indicate that it is a complex quantity which varies in both space and time. Initially, the 2 distributions bear little resemblance, but as the soil dries due to transpiration, they become quite similar. The computations lend support to the model of Molz and Remson (1970) and might be interpreted as indicating the existence of significant impedence to moisture flow in the plant roots under moist conditions. Longitudinal variations in root surface permeability and root growth could also contribute to the computed behavior.--Copyright 1971, Biological Abstracts, Inc.
W72-05242

OXYGEN DIFFUSION FROM THE ROOTS OF RICE GROWN UNDER NON-WATERLOGGED CONDITIONS,
Hull Univ. (England). Dept. of Botany.
W. Armstrong.
Physiol Plant. 24 (2): 242-247. 1971. Illus.
Identifiers: Breakdown, Cortical, Diffusion, Grown, Growth, Non-Waterlogged, Oxygen, Respiration, Rice-M, Roots, Temperature, Tillering, Under.

Three rice varieties, cv. Norin 36, cv. Norin 37 and cv. Yubae, were grown in a loam with a 20 cm water-table which gave aerobic conditions to a depth of not less than 15 to 17 cm. Under these conditions Norin 36 grew more vigorously and tillered more frequently than the other 2 varieties. The rates of O2 diffusion at 23 deg. C from roots up to 11 cm in length were however appreciably lower for Norin 36 (4.3 x 10 to the 8th power g. cm-2 of root surface.min-1) than for Norin 37 or Yubae (c. 7.8 x 10 to the 8th power g). A considerable increase (up to 200%) in the O2 diffusion rate (ODR) from the roots occurred if they were cooled to 3 deg. C, and at this temperature differences in ODR between the varieties were not significant. For a purely physical system, because of the decrease in the diffusion coefficient of O2 in water, and the increase in O2 solubility, a drop of c. 20% in ODR should accompany the above 20 deg. C drop in temperature. A 16% drop was recorded for artificial 'roots' under these conditions. It was concluded that respiratory activity at the higher temperature must have been responsible for the low readings and intervarietal differences observed at 23 deg. C. By increasing the 3 deg. C values by 25% a mean value of 14.2 x 10 to the 8th power g.cm-2 of root surface.min-1 was recorded for the three varieties, being the probable ODR at 23 deg. C in the absence of a respiratory factor. Calculations show that respiratory activity removed enough O2 to reduce the ODR for Norin 36 by more than 9 x 10 to the 8th power g, and for Norin 37 and Yubae by c.6.7 x 10 to the 8th power g.cm-2 of root surface.min-1. Anatomical investigations showed that cortical breakdown was always extensive at 4 to 4.5 cm from the apex of the roots. In some cases however breakdown had not occurred in the basal segment of the root. No opinion could be formed as to whether differences in the amount of cortical breakdown between the varieties might have occasioned the respiratory differences observed. An interesting feature of the root anatomy was the failure of breakdown in those regions of the roots through which lateral roots emerged.--Copyright 1971, Biological Abstracts, Inc.
W72-05245

INFLUENCE OF SOIL MOISTURE AND NPK LEVEL UPON THE GROWTH AND YIELD OF THE ANNUAL CARAWAY (CARUM CARVI L. F. ANNUA.), (IN POLISH),
Antonina Ruminska, and Teresa Mosiej.
Herba Pol. 16 (3): 255-267. 1970. Illus. English summary.
Identifiers: Annual, Caraway-D, Carum-Carvi-F-Annua-D, Growth, Moisture, Nitrogen, Oil, Phosphorus, Potassium, Soil, Volatile, Yield.

The optimum water level was 80% of the water capacity. In these conditions the crop of 14.4 g/pot exceeded about 17-fold that at the critical water level, 40% of the water capacity. NPK fertilizing increased 5-6-fold the crop yields in all water combinations with the exception of the critical value 40% of the water capacity. A sufficient water and mineral nutrient supply resulted in a more economical water management. The use of fertilizers affected the 1000-seed-weight whereas the volatile oil changed mainly in connection with the water level. The highest volatile oil content (5.6%) was reached at 60% of the water capacity. A higher as well as a lower soil moisture decreased the oil content.--Copyright 1971, Biological Abstracts, Inc.
W72-05250

THE TANA IRRIGATION SCHEME: AN INTEGRATED DEVELOPMENT PROJECT,
International Land Development Consultants, Arnhem (Netherlands).
J. A. Baarspul.
Neth J Agric Sci. 19 (2): 76-84. 1971. Illus.
Identifiers: Africa, Crops, Development, East, Integrated, Irrigation, Project, Tana.

The Tana Irrigation Scheme is now a well-functioning settlement scheme where tests on the introduction of new crops can be continued. The results of the last few years have shown that if proper agricultural techniques are applied under good management conditions, the opportunities for the Gaolle farmer are much better than was supposed initially. With careful planning, constant guidance and full support it will even be possible for him to achieve a good deal more. At the Galole Pilot Demonstration and Training Centre technical assistance has proved to be a most valuable tool in development work.--Copyright 1971, Biological Abstracts, Inc.
W72-05252

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

INVERSE SOLUTIONS TO THREE-DIMENSIONAL FREE SURFACE POTENTIAL FLOWS,
Utah State Univ., Logan. Coll. of Engineering.
For primary bibliographic entry see Field 02F.
W72-04808

FLOODS ON YAHARA RIVER, LAKE KEGONSA DAM TO COUNTY LINE, DANE COUNTY, WISCONSIN,
Geological Survey, Madison, Wis.
C. L. Lawrence, and B. K. Holmstrom.
Geological Survey Open-file Report, August 1971. 6 p, 4 fig.

Descriptors: *Wisconsin, *Regional flood, *Flow profiles, *Dams, Floods, Floodwater, Flood plains, Cross-sections, Water management (Applied), Flood protection, Floodplain zoning.
Identifiers: *Flood inundation, Yahara River, Dane County.

The profile and an approximate outline of the flooded area for the regional (100-year) flood has been determined for a 13-mile reach of the Yahara River, Dane County, Wisconsin, from the dam at the outlet of Lake Kegonsa downstream to the county line. The regional flood profile ranges from 0 to 4 feet above normal low-water profiles. (Lang-USGS)
W72-04815

HYDROLOGY OF HUNGRY HORSE RESERVOIR, NORTHWESTERN MONTANA,
Geological Survey, Washington, D.C.
W. D. Simons, and M. I. Rorabaugh.
Available from Sup Doc, GPO-Washington, D.C. 20402 - 65 cents. Geological Survey Professional Paper 682, 1971. 66 p, 28 fig, 40 tab, 8 ref.

Descriptors: *Reservoirs, *Hydrologic data, *Reservoir storage, *Reservoir yield, *Montana, Surface waters, Streamflow, Groundwater, Flow rates, Data collections, Inflow, Evaporation, Stream gages, Water level fluctuations, Geology, Model studies, Precipitation (Atmospheric), Groundwater movement, Water balance, Hydrologic budget, Columbia River basin.
Identifiers: *Hungry Horse Reservoir (Mont).

Hungry Horse Project, on the South Fork Flathead River in northwestern Montana, is an important element in the comprehensive water-resources-development plan for the Columbia River basin. It is used primarily for at-site and downstream power generation and local and downstream flood control. Hungry Horse Reservoir has a usable storage capacity of 2.98 million acre-feet for at-site production of electrical energy. The existence of an additional amount of usable bank storage was established by a comprehensive water-budget analysis. A theoretical model of the response of the aquifer adjacent to the reservoir to changes in reservoir stage was developed. The constants used in the mathematical equations were based on the residuals from the water-budget computations. The model solution indicates that the groundwater storage is 108,000 cfs-days between the elevations of 3,336 and 3,560 feet above mean sea level. This amount of added storage is not totally available as reservoir inflow under normal patterns of regulation because of the time-lag and hysteresis-loop effects of groundwater movement across the interface between the aquifer and the reservoir. (Woodard-USGS)
W72-04821

CATALOG OF RECHARGE BASINS ON LONG ISLAND, N.Y., IN 1969,
Geological Survey, Mineola, N.Y.
G. E. Seaburn, and D. A. Aronson.
Geological Survey Open-file Report, 1971. 28 p, 2 fig, 10 tab, 10 ref.

Descriptors: *Recharge, *Storm runoff, *Diversion structures, *Drainage, *Water storage, *New York, Water conservation, Water supply, Hydrologic data, Data collections, Reviews, Storage capacity.
Identifiers: *Long Island (N.Y.).

Basic data are compiled for 2,124 recharge basins in operation in 1969 on Long Island, N.Y. These data consist of the basins' location, date of construction, capacity to store water, maximum infiltration area, size, bottom altitude, overflow altitude, land-surface altitude, water-table altitude, drainage area, clogging or lack of clogging, use, geologic environment, and soil environment. Tables summarizing the data and a cross reference are included. One of the major methods of disposing of storm runoff from urban and suburban areas on Long Island is to divert the water into recharge basins. This method of disposal, begun in 1935, helps to augment and conserve water in Long Island's groundwater reservoir--the sole source of fresh water for nearly 3 million people in Nassau and Suffolk Counties. Most of the recharge basins are unlined open pits that dispose of storm runoff

from residential, commercial and industrial areas, and from highways. (Woodard-USGS)
W72-04833

PROBLEMS RAISED BY THE APPLICATION OF STOCHASTIC RELATIONS TO HYDROLOGIC VARIABLES AND MEANS OF THEIR SOLUTION (PROBLEMES SOULEVES PAR L' APPLICATION DES RELATIONS STOCHASTIQUES AUX VARIABLES HYDROLOGIQUES ET MOYENS DE LES RESOUDRE),
Grenoble Univ. (France). Laboratoires de Mecanique des Fluides.
For primary bibliographic entry see Field 02A.
W72-04847

WATER BALANCE AND REGIONALIZATION OF DRAINAGE IN THE TURKMEN SSR (VODNYY BALANS I RAYONIROVANIYE DRENAZHA V TURKMENSKOY SSR),
Desert Inst., Ashkhabad (USSR).
G. S. Yefimov.
Izdatel 'stvo 'Ylym', Ashkhabad, USSR, 1968. 108 p.

Descriptors: *Water balance, *Hydrologic cycle, *Drainage, *Drainage systems, Irrigation, Irrigation systems, Irrigation efficiency, Irrigation water, Soil water, Groundwater, Water supply, Water loss, Precipitation (Atmospheric), Evapotranspiration, Leaching, Soils, Crops, Cotton, Alfalfa, Land reclamation.
Identifiers: *USSR, *Turkmen SSR, Kolkhozes, Sovkhozes, Regionalization.

This monograph presents the results of a long-term study of total evaporation and moisture content of soil in the Kopet-Dagh, Murgab-Tedzhen, and Middle and Lower Amu Darya natural irrigation zones of the Turkmen SSR. Leaching rates, crop types in cotton-alfalfa rotations, unit irrigation-water consumption values for cotton-growing farms, and project irrigation efficiencies are used to compute the water balance of the 4 zones, determine drainage moduli (expressed in liter/sec/ha) and average monthly groundwater levels, and to identify drainage types for all irrigated regions of the republic. The text is designed for a wide circle of scientific workers and specialists engaged in the study and planning of reclamation programs and practices. (Josefson-USGS)
W72-04861

PEAKING-STATION LAYOUTS ON HIMALAYAN RIVERS,
Kishau Dam Planning Div., Dehra Dun (India).
R. K. Jain.
Water Power, Vol 23, No 6, p 218-223, June 1971. 8 fig, 1 tab, 2 ref, 2 append.

Descriptors: *Peak power, *Stations, Hydroelectric powerplants, Peak loads (Electric), Flow control, Energy, Demand, Sedimentation, Sediment control, Intake channels, Power, Forebays, Reservoir operation, Discharge measurement, Intake structures, Planning.
Identifiers: India, *Layout, Flow duration curves, *Headworks.

Snow-fed Himalayan rivers are ideal for supplying power to peaking stations because they have high gradients in the reaches beore entering the plains. However, improper layout of these stations can lead to problems in sedimentation, interference of waterways, and discharge and measurement control. These problems and their solutions are discussed. Sediment studies are essential to ensure proper functioning of the power station. Some sedimentation is unavoidable and requires raising the height of the dam. The increased height of the dam can be limited by lowering the water level at the forebay during high river flows with resulting lower reservoir levels. Aqueducts and inverted siphons are feasible for power channel crossings of waterways; however, restrictions imposed by aqueducts should be minimal. Flow measurement and control can be accomplished best at the powerhouse, preferably with a gated structure at the head pond. Regulation is automatic if the intake is ungated and all stations are operated with the same speed-droop characteristics. (USBR)
W72-04875

THE AMELIORATION OF GLEY AND PSEUDOGLEY SOILS,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 02G.
W72-04899

BIOLOGY OF THE CRAYFISH ORCONECTES CAUSEYI AND ITS USE FOR CONTROL OF AQUATIC WEEDS IN TROUT LAKES,
Bureau of Sport Fisheries and Wildlife, Washington, D.C. Div. of Fishery Research.
Jack L. Dean.
U S Bur Sport Fish Wildl Tech Pap 24: 3-13, 1969. Illus.
Identifiers: Aquatic, Behavior, Biology, Breeding, Ceratophyllum-D, Chara, Control, Crayfish, Elodea-M, Lakes, Myriophyllum-D, Orconectes-Causeyi, Polygonum-D, Potamogeton-M, Ranunculus-D, Scirpus-M, Trout, Typha-M, Weeds.

Submerged aquatic plants limit the suitability for trout management of many shallow lakes in the Southwest. Control of these weeds has been achieved by the introduced crayfish O. causeyi. The life history, ecology, and weed-control activities of this crayfish are discussed. Abundant crayfish populations occur over a wide range of elevations in permanent well-oxygenated ponds, lakes, and streams where predaceous warm-water fishes are scarce. Weed control is proportional to the crayfish population and the proximity of a rocky substrate which is the preferred habitat. This crayfish controls several species of Potamogeton, Myriophyllum, Elodea, Ceratophyllum, Ranunculus, Chara, and filamentous algae. It does not control Scirpus, Typha, or Polygonum. Eggs are laid from late March to early May, depending on water temperatures. They hatch from late May through June after being carried 6 to 9 wk and the young remain attached to the adult female 7 to 12 days before becoming free living. Sexual maturity is attained between Aug. and mid-Sept. of the 2nd summer at an age of 14 or 15 mo. Many females die when 24 or 25 mo. old, after producing their 1st brood, but a few survive to produce a 2nd brood. Ovarian egg production averages 588, which is greater than that of any other North American crayfish reported in the literature. The sex ratio is 1:1 for immature individuals, but adult males outnumber adult females 1.5:1. This crayfish is a tertiary burrower establishing relatively shallow burrows for hibernation and egg-hatching periods. It has not damaged dams or irrigation ditches and has been compatible with local agriculture.--Copyright 1971, Biological Abstracts, Inc.
W72-04962

EVALUATION OF RADAR AND RAINGAGE SYSTEMS FOR FLOOD FORECASTING,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 02B.
W72-04966

STOCHASTIC MODELING OF TEMPERATURE AND FLOW IN RIVERS,
Carnegie-Mellon Univ., Pittsburgh, Pa. Div. of Sponsored Research.
For primary bibliographic entry see Field 02A.
W72-05030

APPLICATION OF STREAM ORDER NUMBERS TO THE MERRIMACK RIVER BASIN,
Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
F. Walsh.
Water Resources Research, Vol 8, No 1, p 141-144, February 1972. 2 fig, 2 tab, 5 ref. Partly supported by FWQA.

Descriptors: *Geomorphology, *Drainage patterns (Geologic), *Massachusetts, Drainage density, Channel morphology, Topography, Statistics, Probability.
Identifiers: *Merrimack River (Mass), *Stream order.

The Merrimack River, Massachusetts, satisfies the requirements of a Horton basin. An amendment to the Scheidegger ordering system is proposed, based on the length of stream source segments. These amended orders can be used to identify incorrectly mapped sources and to identify which junctions in a single Scheidegger order have longer than average sources upstream. (Knapp-USGS)
W72-05036

SEEPAGE THROUGH SATURATED AND UNSATURATED LAYERS,
Research Inst. for Water Resources Development, Budapest (Hungary).
For primary bibliographic entry see Field 02G.
W72-05045

THE USE OF NON-DIMENSIONAL ONE--PARAMETER FUNCTIONS FOR THE DETERMINATION OF REGIONAL RAINFALL DEPTH--DURATION-FREQUENCY RELATIONS,
Water Planning for Israel Ltd, Tel Aviv (Israel).
For primary bibliographic entry see Field 02A.
W72-05047

ANALYSIS OF TURBULENT PIPE FLOW,
New York Univ., N.Y. School of Engineering and Science.
For primary bibliographic entry see Field 08B.
W72-05050

CHANGES IN SNOWMELT RUNOFF AFTER FOREST CLEARING ON A NEW ENGLAND WATERSHED,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
J. W. Hornbeck, and R. S. Pierce.
Eastern Snow Conference, Proceedings of the 1969 Annual Meeting, p 104-112, 1969. 5 fig, 5 tab, 3 ref.

Descriptors: *Watershed management, *Clear-cutting, *Snow, *Snow pack, *Water equivalent, *Snow melt, *Water yield, Hydrologic equations, Herbicides, Soil water, Soil water movement, New Hampshire.
Identifiers: *Snowmelt runoff, *No logging, *Peak flows, *Snowmelt season, *Peak accumulation, *Cumulative flow, Hubbard Brook Experimental Forest (N H).

Small gaged watersheds are being used to explore the possibilities of influencing snowmelt runoff from forested areas at Hubbard Brook. On one of the watersheds all trees were cut and left where they fell. Herbicides were applied to prohibit revegetation. Cumulative streamflow was advanced by an average of 4 to 8 days. Earlier and more rapid snowmelt on the cleared watershed caused peakflow volumes to increase in the early part of the melt season and decrease in the later part. Total volume of streamflow for the March 1 to May 15 interval was not significantly changed. The results suggest that clearing as much as 25 percent of a hardwood forested area would not greatly affect the volume of downstream flows during the snowmelt season. (Reeves-Forest Service)
W72-05078

EVALUATING MULTIPLE ECONOMIC EFFECTS OF FORAGE DEVELOPMENT AND MANAGEMENT,
Soil Conservation Service, Portland, Oreg.
E. William Anderson, and Maurice L. Jernstedt.
J Range Manage. 24 (3): 174-180. 1971. Illus.
Identifiers: Development, Economic, Evaluating, Forage, Irrigation, Management, Multiple.

A multiple-effect approach is illustrated for evaluating forage development and management. A nucleus project, such as an irrigated pasture, may result in a chain reaction of other potential adjustments in land use, animal husbandry, and resource management. The benefits are considerably greater than those usually associated with range and pasture projects because multiple effects accrue within the total operation. Some guidelines are presented for evaluating land use, forage management and animal husbandry in conjunction with each other.--Copyright 1971, Biological Abstracts, Inc.
W72-05104

GLACIAL LAKE PASSAIC: PALYNOLOGICAL EVIDENCE FOR DRAINING OF THE GREAT SWAMP STAGE,
Newark State Coll., Union, N.J.
For primary bibliographic entry see Field 02H.
W72-05200

LIMITS ON WESTERN RANGE FORAGE PRODUCTION: WATER OR MAN,
Agricultural Research Service, Logan, Utah. Plant Science Research Div.
Wesley Keller.
J Range Manage. 24 (4): 243-247. 1971.
Identifiers: Evaporation, Forage, Man, Potential, Precipitation, Production, Productivity, Range, Western.

Water is generally regarded as the limiting factor in forage production on arid range-land. If 800 lb. is taken as the water requirement for a pound of range forage, 12 inches as the average precipitation, and 400 lb. as the average forage production/acre, only 12.5% of the precipitation, or 1.5 inches, is used in producing the forage crop. If we estimate that in addition, 1/2 inch is lost to deep percolation, 1 inch to over-the-surface runoff, and 1 inch to undersirable vegetation, we account for 4 inches. Thus, the remainder, 2/3 of the total precipitation, is lost by evaporation, without benefit to man. The importance of the resource lost by evaporation is discussed in relation to the potential productivity of arid lands.--Copyright 1971, Biological Abstracts, Inc.
W72-05230

THE WATER OUTLAY BY EICHHORNIA CRASSIPES AND OBSERVATIONS ON THE PLANT CHEMICAL CONTROL,
Ain Shams Univ., Cairo (Egypt).
Mohamed Ahmed Hammouda.
Phyton (Horn Austria). 13 (1/2): 97-106. 1968. Illus.
Identifiers: Amine, Chemical, Control, 2-4-D, Dalapon, Egypt, Eichhornia-Crassipes-M, Evapo, Lippia-D, Outlay, Paraquat, Plant, Transpiration.

A study of the natural growth of Eichhornia crassipes in a water channel, northern Cairo, was made in 1966 previous to eradication of the plant. Evapotranspiration and transpiration studies were made. Daily evapotranspiration rates in E. crassipes water surface were 1.3-2.6 times evaporation rates from open water surfaces. Measured evapotranspiration rates (ETP) from E. crassipes tanks are 2-3 times higher than potential evapotranspiration (ETP) from Lippia- covered irrigated land. Measured (ETP) of E. crassipes were correlated with a microclimatic character, potential evapotranspiration from plant cover over water surfaces. The plant cannot close its stomata completely and water deficits of considerable extents may occur. Transpiration followed a daily and seasonal pattern correlated with atmospheric factors. Experiments on the effect of 2,4-D amine, paraquat and dalapon on the plant was made and indications of change in relative transpiration after spraying with solutions of different concentrations were considered. 2,4-D amine was the most suitable for control, paraquat was also of value, while dalapon required higher concentrations. Observations on shoot growth, and root elongation with more dilute solutions were given.--Copyright 1971, Biological Abstracts, Inc.
W72-05247

4B. Groundwater Management

ADMINISTRATIVE ALLOCATION OF WATER,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 06E.
W72-04786

RECORDS OF WELLS, DRILLERS' LOGS, AND CHEMICAL ANALYSIS OF GROUND WATER IN GALVESTON COUNTY, TEXAS 1952-1970,
Geological Survey, Austin, Tex.
R. K. Gabrysch, G. D. McAdoo, and W. L. Naftel.
Texas Water Development Board Report 139, Austin, December 1971. 52 p, 1 fig, 4 tab, 5 ref.

Descriptors: *Groundwater, *Water wells, *Logging (Recording), *Chemical analysis, *Texas, Water levels, Hydrologic data, Data collections, Aquifer characteristics, Geology.
Identifiers: *Galveston County (Tex).

Groundwater data collected from 1952 to 1970 in Galveston County, Texas include records of 97 wells and test holes, 60 drillers' logs and 652 chemical analyses of water samples. All wells in Galveston County draw water from the Gulf Coast aquifer. The data are presented in 4 tables, and the locations of the wells are shown on a map. (Woodard-USGS)
W72-04795

THE USE, ABUSE AND RECOVERY OF A GLACIAL AQUIFER,
Williams and Works, Grand Rapids, Mich.
For primary bibliographic entry see Field 05B.
W72-04802

GROUND-WATER LEVELS IN IDAHO, 1971.
Geological Survey, Boise, Idaho.

Idaho Department of Water Administration, Boise, Water Information Bulletin No 24, September 1971. 77 p, 2 fig.

Descriptors: *Groundwater, *Water wells, *Observation wells, *Water levels, *Idaho, Water level fluctuations, Aquifers, Hydrogeology, Depth.
Identifiers: Well locations.

Groundwater levels were measured at 423 selected wells distributed throughout Idaho during 1971. Maps show the location of all network wells in Idaho, the water levels measured in those wells during the spring of 1971, water-level changes occurring in the wells between the spring of 1970 and the spring of 1971, and hydrographs representative of water-levels trends. The locations of wells for which geophysical logs are available, are shown on the area maps. (Woodard-USGS)
W72-04819

GROUND-WATER PUMPAGE FROM THE SNAKE PLAIN AQUIFER, SOUTHEASTERN IDAHO,
Geological Survey, Boise, Idaho.
H. W. Young, and W. A. Harenberg.
Idaho Department of Water Administration, Water Information Bulletin No 23, September 1971. 28 p, 5 fig, 6 tab, 9 ref.

Descriptors: *Groundwater, *Withdrawal, *Pumping, *Water yield, *Idaho, Aquifers, Water users, Irrigation, Hydrologic data, Data collections, Measurement, Methodology, Estimating.
Identifiers: *Snake Plain aquifer (Idaho), Groundwater management.

The amount of groundwater pumped from the Snake Plain aquifer in southeastern Idaho is estimated. Emphasis is placed on the method used to estimate withdrawals for irrigation purposes. Groundwater withdrawals for irrigation needs were computed using the average number of kilowatt-hours of electrical energy consumed per acre-foot of water pumped and the total kilowatt-hours used by irrigation wells. Investigations of 173 wells indicate that about 527 kilowatt-hours are used to pump 1 acre-foot of groundwater from the Snake Plain aquifer. Using this coefficient and the total electrical power consumed by irrigation wells, irrigation pumpage is estimated to be about 1,000,000 acre-feet. Statistical evaluation of the population indicates that the results are accurate to within 10% of actual withdrawals. Municipal groundwater pumpage is estimated to be about 34,000 acre-feet, industrial pumpage about 38,000 acre-feet, and rural-domestic pumpage about 7,000 acre-feet. Total groundwater pumpage from the Snake Plain aquifer in 1969 for irrigation, municipal, industrial, and rural-domestic uses was about 1,079,000 acre-feet. (Woodard-USGS)
W72-04820

HYDROLOGIC DATA FOR HORSESHOE LAKE, ARKANSAS, AND VICINITY,
Geological Survey, Little Rock, Ark. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-04822

ESTIMATED SUBSIDENCE IN THE RAYMOND BASIN, LOS ANGELES COUNTY, CALIFORNIA, FOR A POSTULATED WATER-LEVEL LOWERING, 1970-2020,
Geological Survey, Sacramento, Calif.
B. E. Lofgren.
Geological Survey Open-file Report, 1971. 23 p, 6 fig, 2 tab, 5 ref.

Descriptors: *Groundwater, *Withdrawal, *Pumping, *Land subsidence, *California, Surveys, Forecasting, Regression analysis, Correlation analysis, Water level fluctuations.
Identifiers: *Raymond basin (Calif).

One of the alternate plans for water utilization being considered by the California Department of Water Resources in the Raymond basin in southern California involves partial mining of groundwater during the period 1970-2020, and consequent substantial lowering of water levels. The Department wants to know whether land subsidence would be a problem as a result of the postulated lowering. Water levels in the Raymond basin declined to historic low levels in the mid thirties, then rose and remained above these lows during most of the forties, fifties, and early sixties. Thus, no additional hydraulic stresses were imposed on the water-bearing deposits during this latter period to induce subsidence. Bench-mark control for the 27-year period, 1933-34 to 1961, suggested 0.2 foot of subsidence for most bench marks in and near the basin. This is attributed to network-adjustment problems rather than actual subsidence. At none of the bench marks studied is there a basis for directly relating subsidence to water-level decline. Based on subsidence/head-decline ratios of nearby areas, subsidence would probably be less than 1 foot under proposed pumping stresses. Subsidence would occur so slowly that no problems should result. (Woodard-USGS)
W72-04823

WATER CHEMISTRY OF THE SANTA CLARA VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.

For primary bibliographic entry see Field 02K.
W72-04835

PROGRESS REPORT ON THE ANALOG MODEL STUDY OF THE MAGOTHY AQUIFER IN THE ANNAPOLIS, MARYLAND AREA.
Geological Survey, Parkville, Md. Water Resources Div.
F. K. Mack.
Geological Survey Open-file Report, 1971. 26 p, 5 fig, 4 tab, 13 ref.

Descriptors: *Groundwater, *Water yield, *Analog models, *Aquifers, *Maryland, Water supply, Water wells, Withdrawal, Pumping, Forecasting.
Identifiers: *Groundwater (Magothy aquifer), *Annapolis (Md).

Water needs in the Anne Arundel County, Maryland area have increased rapidly and are expected to continue to increase at least through the year 2000. An electric analog model was used to evaluate the suitability of the Magothy aquifer as a source of large water supplies to help meet growing demands. The model indicates that approximately 60 mgd can be obtained from the Magothy aquifer in the Annapolis area but that a substantial part of the water pumped will be from overlying and underlying formations. Fresh water is being discharged from the Magothy Formation either directly into the Chesapeake Bay and its estuaries or else into streams that discharge into these saline bodies. Lowering of the potentiometric head in the aquifer will reduce the quantity of water discharging from it, thereby salvaging fresh water that is now being lost. Reduction of the natural discharge from the aquifer will also cause a reduction in the flow of streams. (Woodard-USGS)
W72-04840

RECORDS OF WELLS, SPRINGS, AND TEST BORINGS, CHEMICAL ANALYSES OF WATER, SEDIMENT ANALYSES, STANDARD STREAMFLOW DATA SUMMARIES, AND SELECTED DRILLERS' LOGS FROM THE LITTLE KANAWHA RIVER BASIN IN WEST VIRGINIA,
Geological Survey, Charleston, W. Va. Water Resources Div.
For primary bibliographic entry see Field 07C.
W72-04841

DESCRIPTIONS AND CHEMICAL ANALYSES FOR SELECTED WELLS IN THE DOS PALOS--KETTLEMAN CITY AREA, SAN JOAQUIN VALLEY, CALIFORNIA,
Geological Survey, Menlo Park, Calif. Water Resources Div.
For primary bibliographic entry see Field 02K.
W72-04843

QANAT SYSTEMS IN IRAN,
P. Beaumont.
International Association of Scientific Hydrology Bulletin, Vol 16, No 1, p 39-50, March 1971. 7 fig, 5 ref.

Descriptors: *Water resources development, *Reviews, *Alluvium, *Tunnels, Water wells, Water table.
Identifiers: *Qanats, Iran.

For more than two millenia a large proportion of the irrigation water used within the confines of the modern state of Iran has been supplied by unusual horizontal wells known as qanats. Qanats appear to have originated in the vicinity of Armenia more than 2,500 years ago and spread rapidly throughout south-west Asia and north Africa during Achaemenid times, (550 to 331 B.C.). Certainly by 209 B.C. qanats were an important feature of the Persian landscape. Although the methods of qanat construction were carried westwards into the Mediterranean and subsequently into Latin America, qanats and qanat systems attained their maximum development in Iran. (Knapp-USGS)
W72-04849

ALTERNATIVES IN WATER MANAGEMENT,
California Univ., Berkeley. Dept. of Sanitary Engineering.
For primary bibliographic entry see Field 06B.
W72-04893

THE HOME GROUNDWATER SUPPLY PICTURE AS WE SEE IT,
Environmental Protection Agency, Washington, D.C. Div. of Water Hygiene.
For primary bibliographic entry see Field 05F.
W72-04950

HYDROLOGIC DATA FOR THE SAN LUIS VALLEY, COLORADO,
Geological Survey, Denver, Colo.
For primary bibliographic entry see Field 07C.
W72-05025

ALGEBRAIC TECHNOLOGICAL FUNCTION FROM A SIMULATION MODEL,
Harvard Univ., Cambridge, Mass. Center for Population Studies.
For primary bibliographic entry see Field 06A.
W72-05034

ARTIFICIAL RECHARGE OF AQUIFERS (ALIMENTATION ARTIFICIELLE DES NAPPES),
Electroconsult, Milan (Italy).
M. A. Saint-Pe.
International Association of Scientific Hydrology Bulletin, Vol 16, No 2, p 7-25, June 1971. 2 fig, 20 ref.

Descriptors: *Artificial recharge, *Reviews, Hydrogeology, Water management (Applied), Water resources development, Water quality, Topography, Aquifer characteristics, Infiltration.

Artificial recharge is a suitable approach in overall water resources management. The practice, the purposes, the history of recharge, the factors and the problems to be taken into account, the methods, and the economics of artificial recharge are reviewed. Several past examples are quoted as well as two recent projects in the Middle East and North Africa. (Knapp-USGS)
W72-05044

STREAMFLOW, GROUNDWATER AND GROUND RESPONSE DATA--VOLUME II, VENEZUELAN INTERNATIONAL METEOROLOGICAL AND HYDROLOGICAL EXPERIMENT (VIMHEX) HYDROLOGY REPORT,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 07C.
W72-05096

GROUNDWATER LAW, MANAGEMENT AND ADMINISTRATION,
Washington Univ., Seattle. School of Law.
For primary bibliographic entry see Field 06E.
W72-05101

WATER CONSERVATION BY RECLAMATION AND RECHARGE,
Nassau County Dept. of Public Works, N. Y.
For primary bibliographic entry see Field 05D.
W72-05140

BIOLOGICAL AND BACTERIOLOGICAL EVALUATION OF PILOT PLANT ARTIFICIAL RECHARGE EXPERIMENTS,
Prague Dept. of Water Technology (Czechoslovakia).
A. Moravcova, L. Masinova, and V. Bernatova.
Water Research, Vol 2, No 4, p 265-276, 1968. 8 fig, 5 tab, 13 ref.

Descriptors: *Artificial recharge, Copper, *Algicides, Algae, *Evaluation, Filtration.
Identifiers: Silver.

The effect of the algicide CA-350 (a combination of copper and silver) was investigated on four sand filters, models of an artificial recharge basin. Using 300 microgram/1 (ppb) Cu in a preventive treatment the development of filamentous algal forms was fully controlled with the conservation of a normal bacterial microflora. The processes of mineralization of organic matter continued under aerobic conditions. Copper was gradually eluted from the sand layers of the model filters, never reaching its maximum allowable concentration in the outflowing water. (Skogerboe-Colorado State)
W72-05143

4C. Effects on Water of Man's Non-Water Activities

RAINFALL AND RUN-OFF FROM AN INDUSTRIAL AREA IN NAIROBI, KENYA,
Road Research Lab. Crowthorne (England).
J. A. Forsgate, and S. Temiyabutra.
Available from NTIS Springfield, Va, 22151, as PB-203 556, Price $3.00 paper cover, 95 cents microfiche. Road Research Laboratory Report, LR 408, Department of the Environment, 1971. 11 p, 4 fig, 1 tab, 5 ref.

Descriptors: *Rainfall-runoff relationships, *Storm runoff, *Cities, *Urbanization, Overland flow, Hydrographs, Routing, Hydrograph analysis, Flood routing, Flood forecasting, Peak discharge, Recession curves, Mathematical models.
Identifiers: *Nairobi (Kenya), *Urban hydrology, RRL hydrograph method.

Data were collected and analyzed from one urban catchment in Nairobi. Modifications to the RRL Hydrograph Method of sewer design were introduced to allow for its use under conditions of tropical rainfall. The percentage runoff from unpaved areas may be estimated using an antecedent precipitation index; and the resulting contribution to the storm hydrograph is attenuated by routing through a linear reservoir. (Knapp-USGS)
W72-04837

RUNOFF FROM IMPERVIOUS SURFACES,
Kansas Univ., Lawrence. Dept. of Mechanics and Aerospace Engineering.
Y. S. Yu, and J. S. McNown.
Available from NTIS, Springfield, Va 22151 as AD-730 732 Price $3.00 paper cover; 95 cents microfiche. Kansas University Contract Research Report, February 1963. 17 p, 13 fig, 9 ref. DA-22-079-eng-290.

Descriptors: *Rainfall-runoff relationships, *Cities, *Urbanization, Surface runoff, Overland flow, Routing, Numerical analysis, Unsteady flow, Steady flow.
Identifiers: *Street runoff, *Urban hydrology.

Runoff of rain falling on an impervious surface can be predicted by means of numerical computations. For the usually small slopes and depths which occur on highways or airstrips, the nonuniform flow is quasi-steady. The calculation proceeds by steps in the direction of flow, beginning at the upstream end of the reach and with the incidence of rain; repeated computations provide predictions of depths and velocities at subsequent times. Because most of the rain falling is stored on the surface initially, the flow approaches equilibrium quite rapidly. The anomalous increase in discharge which often followed the cessation of rain in field tests is a consequence of turbulent flow becoming laminar when the battering of rain ceases. (Knapp-USGS)
W72-04844

A MODULAR DISTRIBUTED MODEL OF CATCHMENT DYNAMICS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 02E.
W72-04896

TOXICITY AND OXYGEN DEMAND OF DECAYING BARK,
International Pacific Salmon Fisheries Commission, Cultus Lake (British Columbia).
For primary bibliographic entry see Field 05C.
W72-04957

EFFECTS OF URBANIZATION ON STORM WATER RUNOFF QUALITY: A LIMITED EXPERIMENT, NAISMITH DITCH, LAWRENCE, KANSAS,
Kansas State Geological Survey, Lawrence.
E. E. Angino, L. M. Magnuson, and G. F. Stewart.
Water Resources Research, Vol 8, No 1, p 135-140, February 1972. 4 fig, 1 tab, 9 ref. Grant No. 3518-5038.

Descriptors: *Storm runoff, *Water quality, *Cities, *Urbanization, *Water pollution sources, Surface runoff, Kansas, Path of pollutants, Storm drains.
Identifiers: *Lawrence (Kans), *Urban hydrology.

Storm water runoff as an auxiliary source of water is justified economically, providing the water is of proper quality. Water samples were collected in Lawrence, Kansas, in dry weather periods, rainstorms, and snowmelts and evaluated for pH, residue (total, volatile, filterable), chemical oxygen demand, biochemical oxygen demand, N03, Cl and total alkalinity. Suspended solids concentrations during snowmelt and rainstorms do not differ; N03 is relatively high, COD averages 34 ppm (parts per million). Occasional pollutants include Cr, 27 ppm; Br, 5 ppm; and Cl, 2150 ppm Pb concentrations in suspended solids as high as 0.55% were found. (Knapp-USGS)
W72-05035

EFFECT OF ELIMINATION OF VEGETATION ON STREAM WATER QUANTITY AND QUALITY,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 03B.
W72-05076

NEW LANDMARK IN THE WHITE MOUNTAINS,
Forest Service (USDA), Durham, N.H. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02A.
W72-05080

4D. Watershed Protection

A METHOD FOR PREDICTING PEAK FLOWS FROM SMALL RURAL VERMONT WATERSHEDS,
Vermont Univ., Burlington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W72-04897

UNDERSTANDING A WATERSHED FROM THE BIOLOGICAL VIEWPOINT,
Arizona Univ., Tucson. Dept. of Watershed Management.
R. F. Wagle.
Water Resour Bull 7 (2): 244-251, 1971.
Identifiers: Biological, Plants, Soil, Understanding, Watershed.

In watershed management the effects of plants on water cannot be considered a constant and forgotten because plants of the same size differ in their needs for water because of anatomical differences. Many common denominators are present in all watersheds covered by vegetation. Forces exerted on the soil water by vegetation, climate and soil are the same kinds of forces. The differences between watersheds in water yield potential appear to be due to differences in the degree in which these forces are exerted. However, the influence of biotic factors are more individual. The similarities and differences existing between watersheds suggest some principles that can be used as guides to understanding individual watershed problems and as possible guides to determining when, how, and where to treat a given watershed. Eleven principles are given and their application to the definition and solution of biological or vegetational problems of watershed management are discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-04955

THE DISAPPEARING MITCHELL DEKTA,
Melbourne Univ. (Australia). Dept. of Geography.
E. C. F. Bird, and N. J. Rosengren.
Roy Soc Victoria Proc. 84 (1): 153-158. 1971. Illus.
Identifiers: Australia, Conservation, Delta, Disappearing, Erosion, Mitchell, Zostera-M-Spp.

Maps compiled from surveys of 1848-49, air photographs of 1940, and the present (1970) configuration show that the Mitchell River silt jetties, protruding into Lake King, have now been reduced to little more than half the area they had attained 120 yr ago, as the result of shoreline erosion following die-back of a former reedswamp fringe. They will disintegrate and disappear completely within the next 50-100 yr if erosion continues at the present rate. Factors influencing shoreline erosion include the wave regime, the extent of weed growth (Zostera spp.), the presence of driftwood, the effects of grazing stock, and the accumulation of sandy beaches. Shore protection schemes, applied piece-meal, have so far been generally unsuccessful, but in view of the scientific interest and recreational value of the silt jetties, conservation measures (such as the building of rubble walls) are advocated.--Copyright 1971, Biological Abstracts, Inc.
W72-05156

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

REMOVAL OF TRACE METALS FROM MARINE CULTURE MEDIA,
National Marine Water Quality Lab., West Kingston, R.I.
Earl W. Davey, John H. Gentile, Stanton J. Erickson, and Peter Betzer.
Limnology and Oceanography, Vol 15, No 3, p 486-488, May 1970. 1 fig, 5 ref.

Descriptors: *Chelation, Chromatography, Heavy metals, *Trace elements, Radiochemical analysis, Resins, *Sea water, Bioassay, Copepods, Oysters, Dinoflagellates, Diatoms, Algae cultures, Copper, Toxicity.
Identifiers: Chelex 100, Artemia salina, Bio-Rad, Cyclotella nana.

The sodium form of purified Chelex-100 can be used to remove trace metals from artificial and natural seawater without altering the major cation-anion composition or contributing organic toxicants or chelators. Specific contaminant trace metals, often present in artificial seawater at toxic levels, are reduced to levels that permit the growth of sensitive marine phytoplankton and the development of certain invertebrates from the egg through early larval stages. The concentrations of essential trace metals are reduced below the nutritional requirements of selected species of marine phytoplankton. (EPA abstract)
W72-04708

A QUANTITATIVE SAMPLER FOR AQUATIC PHYTOMACROFAUNA,
Ottawa Univ. (Ontario). Dept. of Biology.
G. L. Mackie, and S. U. Qadri.
Journal of the Fisheries Research Board of Canada, Vol 28, No 9, p 1322-1324, September 1971. 1 fig, 1 tab, 8 ref.

Descriptors: *Sampling, *Aquatic animals, Benthic fauna, Submerged aquatic plants, Mayflies, Benthos, Mechanical equipment, Aquatic plants.
Identifiers: *Phytomacrofauna, *Quantitative sampler, Myriophyllum spp., Elodea canadensis, Vallisneria americana, Dugesia tigrina, Stylaria fossularis, Stylaria lacustris, Asellus, Hyalella azteca, Gammarus fasciatus, Crangonyx pseudogracilis, Hydracarina, Odonata, Lepidoptera, Tricoptera, Cricotopus, Gyraulus parvus, Gyraulus hirsutus, Gyraulus deflectus, Promenetus exacuous, Physa gyrina, Amnicola limosa, Ferrissia parallela.

A new sampler has been designed for collecting animals in submerged aquatic macrophytes (phytomacrofauna) independently of benthic macrofauna. The sampler consists of a box of dimensions 28 x 41 x 15 cm with cutter blades and a covering screen in the bottom, and a detachable tapered net for the top. The sampler is used by lowering it into the water, triggering the cutter blades, which cut the macrophytes, and retrieving. The bottom opening is closed by the cover scrren when the blades are triggered, thereby preventing loss of any of the sampled organisms. The macrophytes samples are washed in the detachable tapered net which is in turn washed to remove the phytomacrofauna. The results of an efficiency test of the phytomacrofauna sampler versus an Eckman grab (15 x 15 cm) are listed and show that the phytomacrofauna sampler took more animals per plant species tested. It also worked well in water 2 m deep. (Holoman-Battelle)
W72-04710

A QUANTITATIVE PLANKTON SAMPLER,
Stockholm Univ. (Sweden). Asko Lab.; and Stockholm Univ. (Sweden). Dept. of Zoology.
For primary bibliographic entry see Field 07B.
W72-04713

LIFE HISTORIES AND DRIFTING OF THREE SPECIES OF LIMNEPHILIDAE (TRICHOPTERA),
Freshwater Biological Association, Ambleside (England).
J. M. Elliott.
Oikos, Vol 22, No 1, p 56-61, 1971. 6 fig, 2 tab, 24 ref.

Descriptors: *Caddisflies, *Life history studies, *Streams, Insects, Invertebrates, Benthos, Larvae, Bioindicators, Mayflies, Aquatic drift, Biorhythms.
Identifiers: Chaetopteryx villosa, Drusus annulatus, Anabolia nervosa, Trichoptera, Walla Brook, England, Myriophyllum spicatum L., Callitriche aquatica, Bryophytes, Halesus radiatus, Plecoptera, Pupae, Instars, Anabolia furcata, Periodicity, Dinarthrodes japonica, Glossosoma intermedium, Hydropsyche instabilis, Polycentropus flavomaculatus, Psychoglypha alaskensis, Oligophlebodes sigma, Helicopsyche borealis, Lepidostoma unicolor, Sericostoma personatum, Amiocentrus aspilus.

Large numbers of Limnephilidae were taken in monthly samples of invertebrate drift and benthos from Walla Brook, a small stream on Dartmoor (south-west England). Life histories of Chaetopteryx villosa, Drusus annulatus and Anabolia nervosa are described. Each species had 5 larval in-

stars and a one-year life cycle. Young larvae of C. villosa (instars 1-3) and A. nervosa (instars 2 and 3) built cases of plant material, whereas older larvae built stony cases. Only larvae with plant cases were taken in the drift samples. Drift rates were low in most months. There was little difference between nocturnal and diurnal densities of larvae in the drift, except instar 2 of C. villosa which showed a definite nocturnal periodicity in February, March, and April. Larvae of D. annulatus built cases of stones and were only taken in the drift samples during a severe spate. Imagines of C. villosa, A. nervosa and D. annulatus emerged chiefly at night. There was a definite upstream flight of imagines of C. villosa and A. nervosa. This upstream flight may partially compensate for the downstream drift of larvae. Graphic data for life-histories, larval density, and diel periodicities are present with the results of chi-square analyses of drifting imagines. (Holoman-Battelle)
W72-04714

A SIMPLIFIED TUBE BOTTOM SAMPLER,
Uppsala Univ. (Sweden). Inst. of Zoology.
For primary bibliographic entry see Field 07B.
W72-04715

COMPARISON OF SOME SPECIES IMPORTANCE VALUES AND ORDINATION TECHNIQUES USED TO ANALYSE BENTHIC INVERTEBRATE COMMUNITIES,
Utah State Univ., Logan. Dept. of Wildlife Resources.
D. C. Erman, and W. T. Helm.
Oikos, Vol 22, No 2, p 240-247, 1971. 2 fig, 3 tab, 34 ref.

Descriptors: *Benthic fauna, Statistical methods, Utah, Idaho, Sampling, Chironomids, Computer programs, *Benthos, *Invertebrates.
Identifiers: *Ordination, Bray and Curtis method, Position vectors method, Bear Lake, Ekman sampler, Hygrobates, Procladius culiciformis, Orthocladius, Chironomus digitatus (Malloch), Chironomus undine, Chironomus undine Twones, Chironomus aethiopes, Chironomus aethiopes Townes, Stichtochironomus sp A, Stictochironomus sp B, Polypedilum digitifer, Polypedilum digitifer Townes, Tanytarsus sp A, Data interpretation.

As part of a study of benthic invertebrate communities some aspects of different ordinations were compared. Two ordination methods (the Bray and Curtis and a position vectors type) and two types of species importance values were compared. The importance values were: density times the square root of frequency (DF to the 1/2 power) and oxygen consumption. Two questions were posed: did the two importance values used produce similar rankings of species by order of importance, and did the importance values affect resulting ordinations by different methods. O2-based importance values tended to emphasize the importance of large-sized but relatively low density species, whereas, the opposite effect was obtained by using DF to the 1/2 poweow Although the different importance values significantly changed the relative importance and subsequent ranking of the various invertebrate species, they had little effect on the ordinations by either method. Comparison of the ordination methods indicatedagreement on what was the first or most important axis. Beyond the first axis, the methods did not agree, and the comparisons revealed previously described weaknesses of the Bray and Curtis method. (Mortland-Battelle)
W72-04716

PRIMARY PRODUCTION AND CHLOROPHYLL A CONTENT OF NANOPLANKTON IN A EUTROPHIC LAKE,
Lund Univ. (Sweden). Limnological Inst.
For primary bibliographic entry see Field 05C.
W72-04717

VERTICAL DISTRIBUTION OF SOME CILIATED PROTOZOA IN TWO FRESHWATER SEDIMENTS,
Freshwater Biological Association, Ambleside (Sweden).
For primary bibliographic entry see Field 05C.
W72-04718

DDT IN FOREST STREAMS,
Chemical Control Research Inst, Ottawa (Ontario),
For primary bibliographic entry see Field 05B.
W72-04719

STUDY ON THE NEW STRAIN OF THE PATHOGENIC 'VIBRIO' ISOLATED FROM FRESHWATER FISHES,
H. Kishi, K. Harada, S. Mitsuhashi, and A. Ymamoto.
Fisheries Research Board of Canada Translation Series No. 1575, 1970. 12 p, 2 tab, 8 ref. Translated from Japanese Journal of Bacteriology, Vol 13, No 3, p 256-258, 1958.

Descriptors: *Pathogenic bacteria, *Freshwater fish, Bacteria, Water analysis, Cultures, Bioassay, Sampling, Trout.
Identifiers: *Vibrio, Vibrio piscium, Vibrio cholerae, *Red trout, Salmon-trout, Frunculus-like disease, Japan.

A new pathogenic strain of vibrio, isolated from salmon-trout and water samples collected from a fishpond in the prefecture of Gunnma (Japan) is the causative agent of a frunculosis-like disease in red trout. The biological characteristics and serological and pathogenic properties of this strain have been defined. The vibrio belongs to the third type of Heiberg. (Holoman-Battelle)
W72-04720

POLLUTION DETECTION BY REMOTE SENSING.

Environmental Science and Technology, Vol 5, No 8, p 676-677, August 1971.

Descriptors: *Water pollution control, *Photography, *Remote sensing, Photogrammetry, Spectrophotometry, Infrared radiation, Currents (Water), Virginia, Maryland, Pennsylvania, Delaware, Delaware River, Atlantic Ocean, Aircraft, Satellites (Artificial), Monitoring.
Identifiers: CARETS, James River, Rappahannock River, Chester River, Choptank River, Nantricoke River, Delaware Bay, Chesapeake Bay, Susquehanna River, Wallops Island.

NASA and the U. S. Geological Survey (USGS) are collaborating on a program to monitor pollution concentrations from aircraft or satellites using remote sensing devices. The program, called CARETS (Central Atlantic Regional Ecological Test Site), will run through 1973. A 30,000 square mile area extending from Norfolk, Virginia to Philadelphia and from the Potomac and James Rivers to the Atlantic Seaboard, in addition to several subsites, will be monitored. High flying aircraft, and eventually satellites, employing several types of sensing equipment to gather information will criss-cross the area every 18 days. Photography, both color and black and white, is useful in detecting sediment pollution, water current patterns, and air quality. Infrared photography can be used to detect small thermal differences such as those caused by discharge of heated effluents into bodies of water. Scanning devices operating in the infrared, ultraviolet, and visible spectra are used. Sonar, radar, spectrophotometric, and geomagnetic processes are also useful. The project will include establishment of a data center with the data to be sold by USGS. (Mortland-Battelle)
W72-04726

METHOD FOR THE STORAGE OF SAMPLES FOR DISSOLVED GAS ANALYSES,
Wisconsin Univ., Madison. Water Chemistry Program.
W. C. Weimer, and G. F. Lee.
Environmental Science and Technology, Vol 5, No 11, p 1136-1138, November 1971. 1 fig, 2 tab, 5 ref.

Descriptors: Nitrogen, *Methane, *Sampling, Gas chromatography, Wisconsin, Dissolved oxygen, Laboratory equipment, Lakes.
Identifiers: *Sample preservation, Lake Mary (Wis), Dissolved gases, Van Dorn sampler.

A bottle for storing water samples prior to analysis for dissolved gas concentrations is described. The bottle, which has a teflon stopcock on the side and a long neck fitted with a plunger is designed to prevent exposure of samples to the atmosphere before analysis. Samples are collected by first flushing the bottle, then filling and closing with the plunger to expel a small amount of sample through the stopcock. The stopcock is fitted with a male leur tip to facilitate transferral of the sample through an aerograph valve by depressing the plunger. Analysis of samples from Lake Mary, Wisconsin for dissolved nitrogen and methane indicated that concentrations of these gases remain unchanged in the bottles for a 2-day storage period. It is likely that longer storage periods are possible. The overall method of collection, filling, storing, and analyzing was precise to within plus or minus 7 percent. Apparently instrumentation was the largest source of analytical error while using this method. (Mortland-Battelle)
W72-04729

CHARACTERIZATION OF FOUR MAJOR COMPONENTS IN A TECHNICAL POLYCHLORINATED BIPHENYL MIXTURE,
Central Inst. for Nutrition and Food Research TNO, Zeist (Netherlands).
A. C. Tas, and R. H. deVos.
Environmental Science and Technology, Vol 5, No 12, p 1216-1218, December 1971. 3 fig, 13 ref.

Descriptors: *Pesticide residues, *Toxicity, *Synthesis, *Gas chromatography, *Spectroscopy.
Identifiers: *Polychlorinated biphenyls, Phenochlor Dp 6, Clophen A 60, Aroclor 1260, Chemical structure, Hexachlorobiphenyl, Heptachlorobiphenyl, Gas chromatograms, Infrared spectra.

The exact structures of some major constituents of a commercial polychlorinated biphenyl preparation were determined by synthesis. Gas-liquid chromatography and spectroscopy were used in the determination. The major constituents were: 2,2',4,4',5,5'-hexachlorobiphenyl; 2,2'3,4,4',5'-hexachlorobiphenyl; 2,2',3,4,4',5,5'-heptachlorobiphenyl; and 2,2',3,3',4,4',5-heptachlorobiphenyl. The melting points of the isolated fractions showed no depression when mixed with the corresponding synthetic material. The symmetric compound 2,2',4,4',5,5'-hexachlorobiphenyl can be obtained in a pure form by a relatively simple synthesis and will be used for toxicity studies. (Mortland-Battelle)
W72-04730

LEVELS OF INORGANIC AND TOTAL PHOSPHORUS IN LAKE SEDIMENTS AS RELATED TO OTHER SEDIMENT PARAMETERS,
Wisconsin Univ., Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 05C.
W72-04732

SELENIUM IN LAKE SEDIMENTS - ANALYTICAL PROCEDURE AND PRELIMINARY RESULTS,
Wisconsin Univ., Madison. Water Chemistry Program.
J. H. Wiersma, and G. F. Lee.

Environmental Science and Technology, Vol 5, No 12, p 1203-1206, December 1971. 4 tab, 8 ref.

Descriptors: *Sediments, *Fluorometry, *Trace elements, Wisconsin, South Dakota, Lakes, Reservoirs, Sampling, Dredging, Iron, Manganese, Phosphorus, Analytical techniques.
Identifiers: *Selenium, Lake Mendota, Weber Lake, Big Muskellunge Lake, Trout Lake, Lake Monoma, Lake Waubesa, Crystal Lake, Lake Little John, Lake Minocqua, Sparkling Lake, Lake Kegonsa, Belle Fourche Reservoir, Eckman dredge.

A fluorometric analytical procedure for the determination of selenium in lake sediments is presented. The sample is digested in nitric and perchloric acids. The selenium is reduced and coprecipitated by arsenic and hypophosphorous acid. The precipitate is dissolved in HN03, allowed to react with DAN reagent, and extracted with cyclohexane with the fluorescence being measured on the extract. Selenium content of sediments from 11 Wisconsin lakes and one South Dakota reservoir range from about 1 to 3 micrograms Se/g dry weight. These concentrations are considerably higher than concentrations found in nontoxic soils and soils from low selenium regions of the U. S. indicating that sediments are probably a reservoir for selenium. The variation of selenium with depth in a given lake, the variation of selenium from lakes of different trophic levels, and the variation of selenium concentrations in a sediment core are also reported. A high correlation between selenium and depth as well as with iron, manganese, and phosphorus was shown. (Mortland-Battelle)
W72-04733

METHODS FOR CHEMICAL ANALYSIS OF WATER AND WASTES, 1971.
National Environmental Research Center, Cincinnati, Ohio. Analytical Quality Control Lab.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price $3.00. 1971. 312 p, 24 fig, 27 tab. EPA Project 16020-07/71.

Descriptors: *Volumetric analysis, *Colorimetry, *Spectroscopy, *Spectrophotometry, Acidity, Alkalinity, Biochemical oxygen demand, Bioassay, Chemical oxygen demand, Chlorides, Chlorine, Color, Dissolved oxygen, Fluorides, Distillation, Hardness (Water), Aluminum, Calcium, Chromium, Copper, Iron, Magnesium, Manganese, Potassium, Sodium, Nitrogen, Ammonia, Nitrates, Nitrites, Oils, Carbon, Hydrogen ion concentration, Phenolic pesticides, Phosphorus, Silica, Solid wastes, Sulfates, Sulfides, Water temperature, Odor, Turbidity, Electrodes, Analytical techniques, Heavy metals.
Identifiers: *Sample preservation, Methyl orange method, Autoanalyzer, Arsenic, Cyanides, Atomic adsorption spectroscopy, Cadmium, Lead, Silver, Zinc, Mercury, Methylene blue, Kjeldahl, Grease, Selenium, Specific conductance, Nitrilotriacetate.

This handbook describes chemical analytical procedures to be used in Water Quality Office (WQO) laboratories. Method selection was based on the following criteria: (1) The method should measure the desired constituent with precision and accuracy sufficient to meet the data needs of WQO in the presence of the interferences normally encountered in polluted waters. (2) The procedures should utilize the equipment and skills normally available in the typical water pollution control laboratory. (3) The selected methods should be in use in many laboratories or have been sufficiently tested to establish their validity. (4) The methods should be sufficiently rapid to permit routine use for the examination of a large number of samples. Except where noted under 'Scope and Application' for each constituent, the methods can be used for the measurement of the indicated constituent in both water and wastewaters and in both saline and fresh water samples. Instrumental methods have been selected in preference to manual procedures because of the improved speed, precision, and accuracy. Procedures for the Technicon AutoAnalyzer have been included for laboratories having this equipment available. (Mortland-Battelle)
W72-04735

EFFECTS OF SODIUM CHLORIDE ON OUTGROWTH AND TOXIN PRODUCTION OF CLOSTRIDIUM BOTULINUM TYPE E IN COD HOMOGENATES,
Fisheries Research Board of Canada, Vancouver (British Columbia). Vancouver Lab.
For primary bibliographic entry see Field 05C.
W72-04737

PESTICIDE RESIDUES, INFRARED AND ULTRAVIOLET SPECTRA OF SEVENTY-SIX PESTICIDES,
Perkin-Elmer Corp., Norwalk, Conn.
R. C. Gore, R. W. Hannah, S. C. Pattacini, and T. J. Porro.
Journal of the Association of Official Analytical Chemist, Vol 54, No 5, p 1040-1052, September 1971. 20 fig, 1 tab, 7 ref.

Descriptors: *Infrared radiation, *Spectrophotometry, *Ultraviolet radiation, *Chlorinated hydrocarbon pesticides, *Organophosphorus pesticides, Pesticide residues, Aldrin, Aminotriazole, 2 4-D, DDT, Diazinon, Dieldrin, Heptachlor, 2 4 5-T, Pesticides.
Identifiers: *Infrared spectra, *Ultraviolet spectra, Allethrin, Aramite, Atrazine, Biphenyl, Bulan, Chloranil, Chlorbenside, Chlordane, Chlorobenzilate, CIPC, DDE, Dichlone, Dilan, Dimethoate, Dimite, Dipterex, Dithane D-14, Diuron, DNAP, DNOCHP, DNOCHP (Salt), Duraset, Dyrene, ENP, Ethion, G IPC, Karathane, Kelthane, Lethane 384, Malathion, Maleic hydrazide, Maneb, MCP, Merphos, Methoxychlor, MGK 264, Monuron, Alpha-naphthalene acetic acid, Neburon, Ovex, Parathion, PCNB, Pentachlorophenol, Perthane, Phaltan, o-Phenylphenol, Phostex, Piperonyl butoxide, Prolan, Pyrolan, Randox, Rhothane, Ronnel, SES-T, Sevin, Simazine, Strobane, Sulphenone, Systox, TCNB, Tedion, Thiodan, Thiram, Trithion, Vapona, Vegadex, Warfarin.

Infrared and ultraviolet spectra, along with chemical structures where possible, are given for seventy-six commonly used pesticides. The infrared spectra were obtained on a Perkin-Elmer Model 521 grating infrared spectrophotometer. The ultraviolet spectra were obtained on a Perkin-Elmer Model 450 UV-VISNIR double quartz prism spectrophotometer. The samples were analyzed in the as-manufactured condition without further purification. The infrared and ultraviolet spectra should be useful in the identification of the commonly used pesticides. The ultraviolet spectra, especially, are of quantitative use for estimating detection levels. (Holoman-Battelle)
W72-04738

DIELDRIN LEVELS IN FISH FROM IOWA STREAMS,
Iowa Univ., Iowa City. State Hygienic Lab.
R. L. Morris, and L. G. Johnson.
Pesticides Monitoring Journal, Vol 5, No 1, p 12-16, June 1971. 1 fig, 5 tab, 4 ref.

Descriptors: *Fish, *Dieldrin, *Aldrin, *Adsorption, *DDT, *Path of pollutants, Iowa, Streams, Pesticides, Chlorinated hydrocarbon pesticides, Gas chromatography, Erosion control, Silts, Mississippi River, Missouri River, Runoff, Adsorption, Carp, Buffalo fishes, Bass, Walleye, Pikes, Catfishes, Sunfishes, Agricultural chemicals, Agricultural watersheds, Channel catfish, Carpsucker, White bass.
Identifiers: Heptachlor epoxide, Gamma chlordane, Alpha chlordane, Metabolites, Biological magnification, Biological samples, Cedar River, Big mouth buffalo, Black crappie, White crappie, Black bullhead, Ictalurus punctatus (Rafinesque), Ictiobus cyprinellus (Valenciennes), Cyprinus carpio Linnaeus, Carpiodes sp., Micropterus salmoides (Lecepede), Promoxis nigromaculatus (LeSueurr), Pomoxis annularis Rafinesque, Ictalurus melas (Rafinesque), Lepomis macrochirus Rafinesque, Stizostedion viterum (Mitchell), Esox Lucious Limnaeus, Roccus chrysops (Rafinesque).

Several species of fish from Iowa streams were analyzed to determine the levels of dieldrin and other durable pesticides in the edible portion of their flesh. Composite samples were extracted into 35 percent water/acetonitrile and analyzed by gas chromatography. Catfish had the highest dieldrin levels (up to 1600 ppb). Elevated dieldrin levels were also found in carp and buffalo but not in bass, crappie, bluegill, walleye, and northern pike. Residues of other chlorinated hydrocarbon insecticides were detected in the samples but at levels significantly below the dieldrin concentrations. Traces of DDT and its metabolites, heptachlor epoxide, aldrin, and gamma and alpha chlordane were detected in many of the samples. The rivers studied drain row cropland that is sprayed with aldrin to control agricultural pests. Fish taken from rivers not draining row cropland do not exhibit this phenomenon. Pesticides apparently are absorbed on soil particles and move into streams during rain or snow-melt runoff on erosion silt. Improved soil conservation practices resulting in reduced siltation must be instigated on a broad scale to keep agricultural pesticides on the fields and out of streams. (Holoman-Battelle)
W72-04739

EXPANDED PROGRAM FOR PESTICIDE MONITORING OF FISH,
Bureau of Sport Fisheries and Wildlife, Washington, D.C.
A. Inglis, C. Henderson, and W. L. Johnson.
Pesticides Monitoring Journal, Vol 5, No 1, p 47-49, June 1971. 1 fig, 1 tab, 4 ref.

Descriptors: *Pesticide residues, *Monitoring, *Lipids, DDT, Dieldrin, Aldrin, Endrin, Heptachlor, Colorado River, Columbia River, Delaware River, Hudson River, Mississippi River, Missouri River, Ohio River, Rio Grande, Lake Erie, Lake Huron, Lake Michigan, Lake Ontario, Lake Superior, St. Lawrence River, Tennessee River.
Identifiers: DDE, TDE, BHC, Heptachlor epoxide, Chlordane, Toxaphene, Mercury, Arsenic, Lead, Polychlorinated biphenyls.

Beginning in the fall of 1970, 50 new stations were added to the original 50 stations sampled annually by the Bureau of Sport Fisheries and Wildlife for monitoring pesticide residues in fish. The original 50 stations, sampled since the spring 1967, will be retained in the expanded program. Three composite samples, each containing 3-5 adult fish of a single species, will be collected. All composite samples will be replicated for a total of 600 samples analyzed annually. Residue analyses will be performed for the identification and quantitation of DDT, DDE, TDE, dieldrin, aldrin, endrin, BHC, heptachlor, heptachlor epoxide, chlordane, toxaphene, mercury, arsenic, and lead. Samples will be screened for the presence of interfering polychlorinated biphenyl compounds (PCB's). Fish will be collected and handled in such a manner as to prevent contamination of the sample with extraneous chemicals. (Mortland-Battelle)
W72-04740

POTASSIUM FLUORIDE - A REFERENCE STANDARD FOR FLUORIDE ION ACTIVITY,
Florida Univ., Gainesville. Dept. of Chemistry.
R. A. Robinson, W. C. Duer, and R. G. Bates.
Analytical Chemistry, Vol 43, No 13, p 1862-1865, November 1971. 6 tab, 23 ref.

Descriptors: *Calibrations, *Fluorides, Halides, Electrodes.
Identifiers: *Potassium fluoride, *Ion-selective electrodes, *Fluoride ions, *Activity coefficients, Sodium fluoride, Ion pairing, Potassium ions.

Potassium fluoride is superior to sodium fluoride as a reference standard for the calibration of fluoride-selective electrodes because of its higher solubility and its relative freedom from ion association. Ion pairing in sodium fluoride solutions is demonstrated by an analysis of activity coefficient data in terms of the hydration theory developed by Stokes and Robinson. The fluoride ion has an average hydration number of about 1.9, virtually identical to that for potassium ions. Accordingly, the activity coefficients of potassium and fluoride ions are equal in solutions of potassium fluoride. The ion pair dissociation constant for sodium fluoride is 1.88 on the scale of molality at 25 C, and conductivity measurements are consistent with the conclusion that less ion pairing occurs in solutions of potassium fluoride than in solutions of the sodium salt. Standard values of pF (-log a sub F (-)) useful for the calibration of fluoride ion-selective electrodes over a wide range of fluoride activity are listed. (Holoman-Battelle)
W72-04741

EARTH RESOURCE TECHNOLOGY USED IN POLLUTION DETECTION,
B. M. Elson.
Aviation Week and Space Technology, Vol 95, No 24, p 46-49, December 13, 1971.

Descriptors: *Remote sensing, *Water pollution control, *Sea water, *Oils, *Nutrients, Aircraft, Satellites (Artificial), Phosphorus, Nitrogen, Heavy metals, Organophosphorus pesticides, Industrial wastes, Viruses, Eneric bacteria, Tritium, Radioactive wastes, Monitoring, Photography, Ultraviolet radiation, Fluorescence, Infrared radiation, Radar, Chlorophyll, Water properties, Algae.
Identifiers: Space platforms, Lead, Mercury, Lasers, Microwave radiometry, Video, Scanners.

Various remote sensing devices, carried in aircraft or satellites, are being developed to monitor ocean pollutants. Primary emphasis in this paper is on the detection, identification,mapping, and volumetric measurement of oil spills. One means of detecting some kinds of oils on water is photography in the blue and ultraviolet regions. Fluorescence under ultraviolet light is another means. Oil spill boundaries have been accurately defined using infrared scanners, but certain anomalies are also occurring which limit the usefulness of this technique. Microwave radiometry was used to measure oil spills off the Southern California coast. The Navy has used synthetic aperture radar to perform wide-area surveillance over oil spills. Many pollutants other than oil also can be remotely detected. A multispectral radiometric scanner can be used to determine optical and thermal properties of water and to monitor algal growths and shoreline vegetation. An airborne system for determining chlorophyll content of water has been developed. This technique utilizes a differential radiometer that measures changes in spectral radiance between two or more wavelength regions of the spectrum. (Mortland-Battelle)
W72-04742

ISOLATION AND COUNTING OF ATHIORHODACEAE WITH MEMBRANE FILTERS,
Pennsylvania State Univ., University Park. Dept. of Microbiology.
W. C. Swoager, and E. S. Linstrom.
Applied Microbiology, Vol 22, No 4, p 683-687, October 1971. 3 tab, 13 ref.

Descriptors: *Cultures, *Anaerobic bacteria, *Isolation, *Membrane processes, Bacteria, Sulfur bacteria, Photosynthetic bacteria, Aquatic bacteria, Lakes, Filters, Coliforms, Metabolism, Carbon, Sulfur, Sampling, Water analysis, Algae, Spectrophotometry, Pennsylvania, Inhibitors, Ecology, Ecotypes, Fresh water.
Identifiers: *Athiorhodaceae, Whipple Dam, Stone Valley Dam (Pa.), Atrazine, Biotypes, Pour plate method, Most probable-number test, Membrane filtration, Rhodopseudomonas gelatinosa, Thiorhodaceae, Chlorobacteriaceae.

A membrane filter technique was developed to grow, isolate, and enumerate Athirohodaceae from aquatic ecosystems. Water samples were taken from the spillways of two central Pennsylvania artificial lakes during spring, summer, and fall of 1969. Upper layer and depth samples were taken at 1-m intervals from Stone Valley Dam in May, June, and July 1970. The samples were filtered through a 47-mm HA membrane filter and the filtrate cultured on perforated petri dishes in a carbon-based medium to promote growth of Athiorhodaceae. Atrazine was added to the basal culture medium to inhibit the growth of algae. Absorption spectra were prepared using a Beckman DK-2A spectrophotometer. Pure cultures were isolated by repeated streaking on plates incubated anaerobically in 200-400 ft-C of incandescent light. Identification of the isolates as Athiorhodaceae was corroborated by the fact that they used no sulfide or thiosulfate in culture media and all (40) had spectral characteristics of Athiorhodaceae. Quantitative data and a wide range of biotypes can be obtained by the culturing method described. Accuracy was validated by parallel counts using the pour plate and most probable numbers methods. By using a sulfur-based medium and more anaerobic conditions, the method could probably be used to count and isolate sulfur photosynthetic bacteria such as Chlorobacteriaceae and Thirohadaceae. (Jefferis-Battelle)
W72-04743

DETECTION OF CLOSTRIDIUM BOTULINUM TYPE E IN SMOKED FISH,
Food and Drug Administration, Washington, D.C. Div. of Microbiology.
D. A. Kautter, and T. Lilly, Jr.
Journal of the Association of Official Analytical Chemists, Vol 54, No 5, p 1039, September 1971. 1 tab.

Descriptors: *Clostridium, *Spores, *Toxicity, *Botulism, Bacteria, Fish.
Identifiers: *Whitefish, Clostridium botulinum type E, Clostridium botulinum type B.

Smoked whitefish chubs were inoculated with small numbers of spores of two strains of Clostridium botulinum type E or type B. These were cultured in a medium containing 1 mg trypsin/ml and incubated at 26 or 30 C for 5 days. There was no apparent loss of toxicity of the type E spores incubated at 30 C as compared to 26 C. At 30 C, type B spores showed no increase in toxicity over that obtained at 26 C in previous experiments. Since incubation at 30 C did not increase the toxin titer nor the number of positive samples with proteolytic type B, it is recommended that the conditions best suited for the detection of C. botulinum type E, for which this medium was developed, not be altered. (Holoman-Battelle)
W72-04745

AMOEBIC CYSTICIDAL PROPERTIES OF HALOGENS IN WATER,
Johns Hopkins Univ., Baltimore, Md. School of Hygiene and Public Health.
For primary bibliographic entry see Field 05F.
W72-04746

CULTURAL ESTIMATION OF YEASTS ON SEAWEEDS,
Rhode Island Univ., Kingston. Narragansett Marine Lab.
R. Seshadri, and J. M. Sieburth.
Applied Microbiology, Vol 22, No 4, p 507-512, October 1971. 6 tab, 31 fig.

Descriptors: *Yeasts, *Cultures, *Marine algae, Rhodophyta, Phaeophyta, Chlorophyta, Inhibitors, Antibiotics, Sea water, Rhode Island.
Identifiers: *Agars, Epiphytes, Candida parapsilosis, Chondrus crispus, Rhodotorula glutinis, Sargassum natans, Ascophyllum nodosum, Fucus vesiculosus, Laminaria digitata, Laminaria agardhii, Ulva lactuca, Rhodymenis palmata, Polysiphonia lanosa, Polysiphonia harveyi, Rhodotorula rubra, Rhodotorula lactosa, Candida zeylanoides, Camp Varnum Beach.

Five percent suspensions of freshly harvested seaweeds were used as an inoculum to develop a selective medium for epiphytic yeasts. Conditions for satisfactory yeast growth and visualization as red colonies on membrane filters were obtained by supplementing a basal glucose-Trypticase-yeast extract-agar at pH 7.0 with 100 mg each of chloramphenicol and 2,3,5-triphenyl tetrazolium chloride per liter. Maximal counts were obtained by triturating the algae in prechilled (4 C) seawater with a blender for 2 to 5 min. Inhibitory phenolic materials released from phaeophytes during this process were removed with a modified Cholodny filtration. A preliminary survey indicated that yeasts were epiphytic on all nine species of seaweeds and that maximal populations occurred on the chlorophytes and rhodophytes especially during the periods of warmer water. (Holoman-Battelle)
W72-04748

AN ACTIVE METHOD FOR CORRECTING THE FREQUENCY RESPONSE OF THE TEMPERATURE SENSORS OF OCEANOLOGICAL INSTRUMENTS,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
For primary bibliographic entry see Field 07B.
W72-04749

CHLORINATED HYDROCARBON PESTICIDES IN IOWA RIVERS,
Iowa Univ., Iowa City. State Hygienic Lab.
For primary bibliographic entry see Field 05B.
W72-04753

RESIDUES OF POLYCHLOROBIPHENYLS IN BIOLOGICAL SAMPLES,
Shell Research Ltd., Sittingbourne (England). Tunstall Lab.
A. Richardson, J. Robinson, A. N. Crabtree, and M. K. Baldwin.
Pesticides Monitoring Journal, Vol 4, No 4, p 169-176, March 1971. 6 fig, 2 tab, 21 ref.

Descriptors: *Pesticide residues, *Gas chromatography, *Birds, Herring, Bird eggs, DDT, Salmon, Lake Michigan, Endrin, Dieldrin, Heptachlor, Chlorinated hydrocarbon pesticides, Fish.
Identifiers: *Polychlorinated biphenyls, *Mass spectroscopy, Shag, Heron, Fish oil, Aroclor 1254, DDE, Coho salmon, DDD, Chemical interference, Biological samples, Mass spectra.

A method for determining chlorinated pesticides in environmental samples consists of extraction with hexane or hexane/acetone followed by cleanup with dimethylformanide, hexane partition, liquid-solid chromatography on Florisil, and determination of the insecticide by electron-capture, gas-liquid chromatography. Details of the method are given for determining concentrations of one part per hundred million in animal tissue, fats, oils, and eggs. Comparison of relative retention times for gas chromatography of herring oil and heron egg samples with those of Aroclor 1254 suggested that chlorinated biphenyls might be present. This was supported by the detection of similar peaks with similar retention values by the microcoulometric detector. Mass spectroscopy coupled with gas chromatography was used to positively identify the components responsible for interference in determining organochlorine insecticides. The presence of halogenated compounds other than organochlorine insecticides in environmental samples presents an analytical problem that may not be solved by gas chromatography. Using current

analytical procedures, it is impossible to quantitatively determine polychlorinated biphenyls in the environment with any degree of confidence. (Mortland-Battelle)
W72-04754

THE IMPACT OF VARIOUS HEAVY METALS ON THE AQUATIC ENVIRONMENT,
Environmental Protection Agency, Denver, Colo. Water Quality Office.
For primary bibliographic entry see Field 05B.
W72-04792

DETERMINATION OF TRITIUM IN WATER BY THE U.S. GEOLOGICAL SURVEY, DENVER, COLORADO,
Geological Survey, Denver, Colo.
L. J. Schroder.
Available from NTIS, Springfield, Va 22151 $3.00 (printed); 95 cents microfiche. Geological Survey Report USGS-474-134, 1971. 22 p, 9 ref. Agreement No AT (29-2)-474.

Descriptors: *Tritium, *Water resources, *Radiochemical analysis, *Laboratory tests, Methodology, Spectrometers, Hydrologic aspects, Environmental gradient, Suface waters, Nuclear energy, United States.
Identifiers: *Liquid scintillation techniques.

The methods and procedures used to analyze natural waters for tritium activity, and the procedures used to calculate tritium activity and laboratory detection levels of tritium are described. The U. S. Geological Survey at the Denver Federal Center, Colorado assays the radioactive isotope concentrations of water using liquid scintillation techniques. Normally, 600 to 800 samples a year of water with a detection level ranging from 150 to 400 tritium units are analyzed. (Lang-USGS)
W72-04842

ADVANCES IN THE CONTINUOUS CULTURE OF PLANKTONIC COPEPODS,
National Marine Water Quality Lab., West Kingston, R.I.
E. J. Zillioux, and N. F. Lackie.
Helgolaender Wisschaftliche Meeresuntersuchungen, Vol 20, p 325-332, May 1970. 3 fig, 1 tab, 5 ref.

Descriptors: *Copepods, *Recirculated water, *Cultures, Organic matter, Aquatic animals, Zooplankton, Laboratory equipment.

The development of a system for the continuous culture of planktonic copepods was described by Zillioux * (Mar. Biol. Vol 4, p 215-218, 1969). In this system, which utilizes ciliate control of bacterial population and algal debris, and foam separation as a means to limit accumulation of dissolved organics, the copepods Acartia clausi and A. tonsa have been cultured for over a year with frequent harvesting. It was realized, however, that while successful continuous culture had been obtained, certain improvements would increase the value of this system. Construction modifications which improve the efficiency and broaden the versatility of a recirculating culture system for planktonic copepods are described. Folin protein, dissolved organic carbon and particle content have been measured to determine relative efficiencies of two foam towers under different conditions. A combined settling and filtration tank has been designed to facilitate flow-through adaptation of the culture system.
W72-04900

DETERMINATION OF NITRILOTRIACETIC ACID BY HIGH-SPEED ION EXCHANGE CHROMATOGRAPHY,
National Environmental Research Center, Cincinnati, Ohio. Analytical Quality Control Lab.
J. E. Longbottom.
Analytical Chemistry, Vol 44, No 2, p 418-420, February 1972. 5 fig, 2 tab, 14 ref.

Descriptors: *Detergents, Sewage, *Chromatography, Anion exchange, Water analysis, Amino acids, Chelation, Ion exchange, Metals, Analytical techniques, Phosphates, Pollutant identification.
Identifiers: *NTA, *Nitrilotriacetic acid, Heavy metals, *Liquid chromatography, *EDTA, Detergent formulations, *Chelates, UV absorbance.

A method for the quantitative determination of Nitrilotriacetic acid (NTA) in the presence of heavy metals and other amino-acid chelates was developed. The method employs ion-exchange chromatography and detection of UV absorbance at 254 nm. The method has been applied to detergent formulations with success. Sewage samples can be analyzed after filtration by direct aqueous injection with a sensitivity of 1.0 mg/l and a precision of 0.1 mg/l. Metal interferences are handled by the column or by the addition of ferric ion followed by the chromatography of the ferric-NTA chelate. (EPA abstract)
W72-04901

A COMPARATIVE STUDY ON FATTY ACID COMPOSITION OF THE NATIVE AND REARED SILVER CARPS, BIG HEADS, AND GRASS CARPS,
Y. Shimma, and H. Shimma.
Bull Freshwater Fish Res Lab. 19 (1): 37-46. 1969.
Identifiers: Aristichthys-nobilis, Big, Carps, Comparative, Composition, Ctenopharyngodon-idellus, Fatty-acid, Feed, Grass, Heads, Hypophthalmichthys-molitrix, Native, Reared, Silver.

Lipids were extracted from several tissues of native silver carp Hypophthalmichthys molitrix, reared big heads Aristichthys nobilis, and native and reared grass carp Ctenopharyngodon idellus. Their fatty acid compositions were analyzed by gas chromatography. The dorsal flesh contained 0.5-1.8% of lipids in all fishes, and 87-108 mg% of cholesterol in big head, and 39-75 mg% of cholesterol in the others. The fatty acid compositions of the dorsal flesh of the native fish were almost similar to each other having 16:0, 16:1, 18:0, 18:1, 20:4, 20:5, and 22:6 acids as major components. The depot lipids of ventral flesh and abdominal and skull cavities of grass carp showed different compositions of fatty acids from silver carps, having higher contents of 18:2 and 18:3 acids. Analysis of lipids of 6 samples of water plants, indicated large amounts of 18:2 and 18:3 acids in their leaves. High contents of these acids in grass carp depot lipids might come from their feed plants. A slight difference in fatty acid composition was observed between the native silver carp and reared big head. Lipids of the reared grass carp were distinctly affected by feed. In fish fed with marine fish (Decapterus lajang), 22:6 acid was found 24.3-32.6% in the dorsal flesh, hepatopancreas and milt, while in lipids of fish given a commercial feed 22:6 acid amounted to 10.4-13.3% in the dorsal flesh and hepatopancreas, 7.2-8.6% in milt and 14.6% in eggs.--Copyright 1971, Biological Abstracts, Inc.
W72-04914

SEMIQUANTITATIVE DETERMINATION OF POLYCHLORINATED BIPHENYLS IN TISSUE SAMPLES BY THIN LAYER CHROMATOGRAPHY,
Bureau of Sport Fisheries and Wildlife, Laurel, Md. Patuxent Wildlife Research Center.
Bernard M. Mulhern, Eugene Cromartie, William L. Reichel, and Andre A. Belisle.
J Ass Offic Anal Chem. 54 (3): 548-550, 1971. Illus.
Identifiers: Aroclor, Bi, Chlorinated, Chromatography, DDE, Determination, Industrial, Layer, Pesticide, Phenyls, Plasticizer, Poly, Residue, Samples, Semiquantitative, Thin, Tissue, Wildlife.

The analysis of wildlife samples for organochlorine pesticide residues is complicated by the presence of polychlorinated biphenyl (PCB) compounds. PCB compounds, which are multipurpose industrial plasticizers marketed in the USA under the trade name Aroclor, have retention times identical with most organochlorine insecticides and their metabolites. A method for partial separation of PCB by thin layer chromatography (TLC) and for quantitation of the chlorinated insecticides by gas-liquid chromatography (GLC) has been reported for the analysis of wildlife specimens. A method is described for the analysis of PCB compounds in tissue samples. Cleanup by hexane-acetonitrile partitioning and Florisil column chromatography are performed on samples before oxidative treatment to convert DDE to DCBP (4,4-dichlorobenzophenone). PCB components are then determined semiquantitatively by TLC. No prior separation of PCB from chlorinated pesticides is required. The lower limit of sensitivity is 0.2 microgram.--Copyright 1971, Biological Abstracts, Inc.
W72-04946

COLLABORATIVE STUDY OF A METHOD FOR MULTIPLE CHLORINATED PESTICIDE RESIDUES IN FISH,
Food and Drug Administration, Cincinnati, Ohio.
Richard L. Carr.
J Ass Offic Anal Chem 54 (3): 525-527, 1971.
Identifiers: BHC, Chlorinated, Collaborative, DDE, DDT, Dieldrin, Epoxide, Fish, Heptachlor, Method, Multiple, Pesticide, Residues.

Eight laboratories participated in a collaborative study of a method for chlorinated pesticide residues in fish. Gas chromatography was used for quantitative measurement of the residues. The study consisted of 3 fish samples; 2 were fortified with each pesticide at 2 levels and the 3rd sample contained incurred residues of p,p'-DDE and p,p'-TDE. Average recoveries for both fortified levels were: alpha-BHC, 92.2 plus or minus 14.9%; heptachlor expoxide, 91.6 plus or minus 8.8%; p,p'-DDE, 87.5 plus or minus 13.5%; p,p'-TDE, 88.6 plus or minus 11.4%; p,p'-DDT, 90.6 plus or minus 9.7%; and dieldrin, 82.2 plus or minus 25.4%. In most instances, residues were confirmed by TLC (thin layer chromatography). The method was adopted as official 1st action for determination of residues of these 6 pesticides in fish.--Copyright 1971, Biological Abstracts, Inc.
W72-04947

RAPID DETERMINATION OF MERCURY IN FISH,
Cornell Univ., Ithaca, N.Y. Pesticide Residue Lab.
Carl A. Bache, Colin McKone, and Donald J. Lisk.
J Ass Offic Anal Chem 54 (3): 741-743, 1971.
Identifiers: Determination, Dithizonate, Fat, Fish, Mercuric, Mercury, Method, New, Oil, Pesticide, Rapid, Residues, Samples.

Successful O2 flask combustion of samples of high oil or fat content was particularly different in the past. A method is described for analysis of Hg in fish by modified Schoniger combustion and colorimetric determination of mercuric dithizonate. The recovery of Hg added to fish at the 0.5 ppm level was satisfactory.--Copyright 1971, Biological Abstracts, Inc.
W72-04948

TOTAL COLIFORM: FECAL COLIFORM RATIO FOR EVALUATION OF RAW WATER BACTERIAL QUALITY.

J Water Pollut Control Fed 43 (4): 630-640, 1971. Illus.
Identifiers: Bacterial, Coliform, Fecal, Ratio, Raw.

Appraising the bacterial quality of river water relative to required water quality standards in the USA placed new importance on differentiating between fecal and nonfecal coliform organisms. The total coliform count traditionally used for determining bacterial quality does not give an adequate and accurate appraisal of bacterial water quality conditions. The fecal coliform group can be reliably and easily cultured in the laboratory to

be used with the membrane and multiple-tube dilution test techniques. In tests conducted in the Ohio River Valley, fecal colform testing was used to produce reliable data; an average ratio of fecal coliforms to total coliforms for 6 sampling stations is 0.14, but this ratio increases to about 0.20 in the vicinity of wastewater treatment plant discharges. The fecal coliform test seems to be the most accurate bacteriological measurement now available for detecting warm-blooded animal feces in polluted water.--Copyright 1971, Biological Abstracts, Inc.
W72-04952

A COLORIMETRIC METHOD FOR AMMONIA IN NATURAL WATERS,
National Inst. for Water Research, Pretoria (South Africa); and Council for Scientific and Industrial Research Pretoria (South Africa).
J. E. Harwood, and A. L. Kuhn.
Water Res 4 (12): 805-811, 1970. Illus.
Identifiers: Ammonia, Colorimetric, Method, Natural, Waters.

An improved phenol-hypochlorite method for determining ammonia in water using nitroprusside as catalyst was investigated. Unlike other recently published methods, the method is simple (and sufficiently sensitive for low-level analyses) and does not require accurate time intervals between reagents. The method is well suited for routine use. Beer's Law was obeyed over the whole ammonia range investigated. Reproducibility was 1.3% with 10 microgram N, and 5.7% with 1 microgram N.--Copyright 1971, Biological Abstracts, Inc.
W72-04964

NUTRIENTS AND CARBON DIOXIDE IN THE COLUMBIA RIVER,
Oregon State Univ., Corvallis. Dept. of Oceanography.
For primary bibliographic entry see Field 05B.
W72-04974

FORMS OF INORGANIC NITROGEN IN DOMESTIC WASTEWATER,
Wisconsin Univ., Madison. Water Chemistry Program.
Arthur M. Hanson, and G. Fred Lee.
Journal Water Pollution Control Federation, Vol 43, No 11, November 1971, p 2271-2279. 11 tab, 12 ref.

Descriptors: *Nitrogen, *Municipal wastes, *Industrial wastes, Ammonia, Amino acids, Ureas, Hydrolysis, Freeze drying, Separation techniques, Analytical techniques, Nutrients, Laboratory tests, Wisconsin, Pollutant identification.
Identifiers: *Madison (Wisc).

Influent wastewaters from two municipal wastewater treatment plants were sampled, and by the procedures selected, about 80% of the total nitrogen was accounted for. A macro-version of the microsteam distillation procedures for nitrogen determinations was developed when serious foaming problems were encountered. In Madison, Wisconsin raw wastewater, free NH3-N averaged 60% of the total -N, urea-N averaged 7.6% of total-N, and amino acids-N averaged 12.5% of total-N. In Cross Plains raw wastewater, NH3-N averaged 60%, urea-N averaged 14.5%, and amino acids-N averaged 7.1% respectively of total N. Free alpha-amino acid-N was detected only 4 times in a total of 20 analyses of Madison area wastewater. Separation and removal of carbohydrates and hydroxylbenzene compounds before vacuum evaporation, freeze-drying, and acid hydrolysis of wastewater should improve the accuracy of analyses for specific forms of nitrogen. (Lowry-Texas)
W72-04981

ORGANOCHLORINE INSECTICIDE RESIDUES IN FISH-FALL 1969: NATIONAL PESTICIDE MONITORING PROGRAM,
Bureau of Sport Fisheries and Wildlife, Washington, D.C. Div. of Fishery Research.
Croswell Henderson, Anthony Inglis, and Wendell L. Johnson.
Pestic Monit J. 5 (1): 1-11. 1971. Map.
Identifiers: Chlorine, Fall, Fish, Insecticide, Monitoring, National, Organo, Pesticide, Program, Residues.

The fish monitoring program conducted by the Bureau of Sport Fisheries and Wildlife since 1967 was continued in 1969. A total of 147 composite fish samples were collected at 50 nationwide monitoring stations during the fall of 1969. Each sample was analyzed by a commercial laboratory for residues of 11 organochlorine insecticides, lipids, and polychlorinated biphyenyls (PCB's). DDT and/or metabolites were found in all samples with residue levels of total DDT (DDE + TDE + DDT) ranging from 0.03 to 57.8 ppm (mg/kg, wet weight, whole fish). Dieldrin residues ranging from 0.01 to 1.59 ppm were found in all but 10 of the 147 samples. Other organochlorine insecticides were found less frequently. Confirmatory analyses were conducted on some samples, and studies were made to determine effects of PCB's on insecticide residue analyses.--Copyright 1971, Biological Abstracts, Inc.
W72-04982

COMBINED HIGH SPEED LIQUID CHROMATOGRAPHY AND BIOASSAY FOR THE EVALUATION AND ANALYSIS OF AN ORGANOPHOSPHORUS LARVACIDE,
Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
R. A. Henry, J. A. Schmit, J. F. Dieckman, and F. J. Murphey.
Anal Chem. 43 (8): 1053-1057. 1971. Illus.
Identifiers: Abate, Bioassay, Chromatography, Larvacide, Liquid, Mosquito, Pesticide, Phosphorus, Speed, Toxicity.

High speed liquid chromatography was used to detect and isolate impurities in the pesticide, Abate (O,O,O',O'-tetramethyl-O,O'-thiodi-p-phenylene phosphorothioate). The toxicity of the parent compound and each major impurity to mosquito larvae was determined in a bioassay experiment. The same chromatographic system was also used for the rapid quantitative determination of Abate in water. Samples were extracted with chloroform or n-heptane, concentrated by evaporation, and chromatographed without further cleanup. The UV photometer detector used in the study was sensitive to about 1 ng of Abate. The persistence of Abate was investigated in salt marsh ponds and also under simulated pond conditions in the laboratory. Abate was strongly associated with pond organic matter and dropped rapidly to a steady state concentration in the pond water. The level of Abate on mosquito larvae killed by the pesticide was investigated by an extraction technique and also by direct introduction of larvae into the inlet of the chromatographic column. Results indicated that Abate-killed larvae were concentrating the pesticide 100 times over the bulk pond concentration at normal field dosage levels.--Copyright 1971, Biological Abstracts, Inc.
W72-04997

TRACE ELEMENT ANALYSIS OF ENVIRONMENTAL SAMPLES BY NEUTRON ACTIVATION METHOD,
Washington State Univ., Pullman. Coll. of Engineering Research Div.
Surinder K. Bhagat, William H. Funk, Royston H. Filby, and K. R. Shah.
Journal Water Pollution Control Federation, Vol 43, No 12, December 1971, p 2414-2423. 4 fig, 5 tab, 10 ref.

Descriptors: *Trace elements, *Neutron activation analysis, Efficiencies, Cost analysis, Irradiation, Radioisotopes, Analytical techniques, Laboratory tests, Sampling, Water quality control, Pollutant identification.
Identifiers: *Sensitivity.

High flux neutron activation analysis, already widely used for coding merchandise to foil counterfeiters, tracing oil pollution sources, and measuring pesticide residues in foods, has been adapted for use in determining trace element concentrations in environmental samples. The method involved exposing the sample to be analyzed to a high flux of neutrons which interact with the elements in the sample. This interaction produces radioisotopes that can be identified by their characteristic decay rates and type and energy of emitted radiation. The analysis is fast and accurate, and has shown promise of increasing the detection sensitivity of a number of elements by factors of 10,100 or more, as well as making possible the discovery of elements not previously found in marine organisms. In addition, several elements can be determined simultaneously from the same sample, and utilization of computers which receive raw data directly from the pulse height analyzers and printout information directly has speeded up the analysis. Solid, liquid, or gaseous samples can be analyzed, and as little as a few milligrams of sample is sufficient for precise work. If the number of samples is large, the cost per sample for a commercial analysis may run from $10 to $15 for one element with a smaller incremental cost for each additional element. (Lowry-Texas)
W72-04998

STRONTIUM-90, STRONTIUM AND CALCIUM IN SOME AQUATIC ORGANISMS FROM THE SEA OF OKHOTSK, (IN RUSSIAN),
Institute of Biology of the Southern Seas, Sevastopol (USSR).
G. V. Kostareva, A. A. Buchurin, and N. V. Sokolova.
Radiobiologiya. 10 (1): 145-147. 1970.
Identifiers: Aquatic, Atlantic, Calcium, Chuckchee, Clupea-Harengus-Pallasi, Eleginus-Gracilis-Telesius, Indian, Lepidopsetta, Ocean, Odontogadus, Okhotsk, Oncorhynchus, Organisms, Phoca-Hispida, Pleuronectis-Platessa, Sea, Strontium, Stronium-90, USSR.

The concentration of Sr90 and the concentration and accumulation coefficients of Sr and Ca were determined in some seal and fish species (Eleginus gracilis tilesius, Oncorhynchus, Clupea harengus pallasi, Lepidopseta, Pleuronectes platessa, Odontogadus, Phoca hispida) in the Sea of Okhotsk. A comparison of these findings with data reported in the scientific literature showed that the Sr 90 level in the aquatic species studied is comparable to that noted in fish in the Indian and Atlantic oceans and for seals in Chuckchee Sea. The discrimination coefficients of Sr in relation to Ca are the same for fish of different seas. The concentrations of Sr and Ca in related species of fish from seas with different salinity were close.--Copyright 1971, Biological Abstracts, Inc.
W72-04999

THE TOTAL ORGANIC CARBON ANALYZER AND ITS APPLICATION TO WATER RESEARCH,
Washington Univ., Seattle. Water Biology.
Russel F. Christian, Richard M. Emery, and Eugene B. Welch.
Journal Water Pollution Control Federation, Vol 43, No 9, September 1971, p 1834-1844. 13 fig, 5 ref.

Descriptors: *Instrumentation, *Analytical techniques, *Infrared radiation, On-site investigations, Research and development, Temperature, Sampling, Absorption, Condensation, Oxidation, Biochemical oxygen demand, Chemical oxygen demand, Carbon dioxide, Water quality control, Pollutant identification.
Identifiers: *Total organic carbon analyzer, *Combustion.

Because of the system provided for carbon combustion, and the method used for CO2 detection by a nondispersive infrared analyzer requiring no monochromator, the Total organic carbon (TOC) analyzer seems to offer the most rapid and accurate analysis available for organic carbon. Allowing time for warm-up of the combustion furnaces, a single carbon value can be determined in 2 min. with an accuracy of 1 percent of full scale and a sensitivity of plus or minus 1 mg/l. Studies by the TVA showed that total and organic carbon concentrations determined by the TOC analyzer are positively correlated with both long-term (r = 0.72,S = 0.12 mg biochemical oxygen demand) (BOD)/day/day) and 5-day (r = 0.69,S = 0.15mg BOD/day/ day)BOD rates. Chemical oxygen demand (COD) was also shown to be strongly correlated with total (r = 0.93,Se = 25.8 mg COD/1) and organic (r = 0.93,Se - 26/1 mg COD/1) carbon (as determined by a total carbon analyzer) in municipal wastewater samples from three cities in Michigan. More investigations into the relationships between carbon content and oxygen demand may possibly allow development of reliable prediction factors and equations for the renovation and design of water and wastewater systems that receive interference from biological and chemical oxidation mechanisms. (Lowry-Texas)
W72-05001

A NEW CONCEPT IN SAMPLE PRESERVATION--POISONING AND DEPOISONING,
Oregon State Univ., Corvallis. Dept. of Civil Engineering.
Frank D. Schaumberg.
Journal Water Pollution Control Federation, Vol 43, No 8, August 1971, p 1671-1680. 8 tab, 9 ref.

Descriptors: *Sampling, *Preservation, *Poison, *Refrigeration, Heavy metals, Toxicity, Inhibition, Biodegradation, Chemical reactions, Biochemical oxygen demand, Chelation, Stability, On-site investigations, Analytical techniques, Waste water treatment.

Preservation of biological samples has been mainly by refrigeration. A mercury poisoning preservation method has recently been developed and tested on various BOD contributing substrates, including glucose, beet cannery waste, and settled domestic wastewaters. The process involves dosing each biological sample with from 2 to 25 mg/l of Hg++. When the sample is to be analyzed, a chelating agent is used which can reduce the concentration of Hg++ in the poisoned sample to 0.03 mg/l (Mercury has been shown to inhibit BOD reactions at concentrations above 0.1 mg/l as Hg++). The poisoning-depoisoning method was comparable to refrigerated storage at 40C. However, this method is intended as a supplement to, not a replacement for, existing preservation techniques. Refrigerated storage remains the logical choice since refrigeration inhibits chemical and physical reactions, as well as biological reactions. (Lowry-Texas)
W72-05012

BACTERIAL COUNTS OF A SECTION OF THE RED RIVER -- SUMMER, 1970,
North Dakota State Univ., Fargo. Dept. of Bacteriology.
M. C. Bromel.
North Dakota Farm Research, North Dakota University Reports on Environmental Quality, Vol 4, No 28, p 60-61, March-April, 1971.

Descriptors: *Water pollution, *Coliforms, *Waste dilution, North Dakota, Cultures, Oxygen demand, Treatment facilities, Salmonella, Clostridium, Shigella, Fishkill.
Identifiers: *Red River, Bacteriological analyses, Coliform count.

Numerous surveys by state and federal agencies from 1935-1969 indicate that the Red River has become progressively more polluted as the municipal and industrial population along its banks increase. During the summer of 1970, from June 8 through July 28 an intensive biological and bacteriological survey of the Red River was undertaken. Surface and bottom water samples were collected from a boat with a Van Dorn water sampler. Biological and chemical analysis on each sample included the following determinations: dissolved oxygen, pollution, number of animals sensitive to pollution, and total suspended solids. The bacterial counts, especially the coliform counts, were far over the 5,000/100 ml allowable by North Dakota and Minnesota standards for potable or recreational water. There was consistently present a high concentration of bacteria in the Red River at the Fargo intake averaging 500,000 bacteria per milliliter of water. The dissolved oxygen level at several sites was below the two-state standard (5 ppm) minimum. The presence of Shigella dysenteriae in the Wild Rice River when the coliform count was very low (500/ml) is remarkable since this form of Shigella is very rarely found in the U.S. (Dorland-Iowa State)
W72-05056

THE RELATIONSHIP OF DRYING TEMPERATURE TO TOTAL CRUDE PROTEIN IN DRIED POULTRY WASTE,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
For primary bibliographic entry see Field 05E.
W72-05062

ODORS, GASES AND PARTICULATE MATTER FROM HIGH DENSITY POULTRY MANAGEMENT SYSTEMS AS THEY RELATE TO AIR POLLUTION,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W72-05067

THE QUALITATIVE DETERMINATION OF THE ODOR QUALITY OF CHICKEN MANURE,
Cornell Univ., Ithaca, N.Y. Dept. of Food Science.
For primary bibliographic entry see Field 05B.
W72-05068

THE QUANTITATIVE DETERMINATION OF THE ODOR STRENGTH OF CHICKEN MANURE,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel, and W. E. Burnett.
In: Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution. Final Report, New York State Dept. of Health, Division of Air Resources, Ithaca, New York, p 18-39, April 15, 1969. 5 fig, 3 tab, 12 ref.

Descriptors: *Farm wastes, *Odor, Waste dilution, Poultry, Ammonia, Moisture content, *Air pollution.
Identifiers: *Vapor dilution, *Liquid dilution, Manure strength, Cage-laying hens, Olfactory threshold test, Fresh manure.

Strength is a characteristic of an odor that can be measured. In contrast to characteristics such as quality and occurrence which rely only on individual opinion, strength allows associating a number with an odor. The method of liquid dilution and the method of vapor dilution have been investigated. Odor strength of animal manures can be measured on a laboratory basis by the liquid dilution and the vapor dilution methods. The vapor dilution method looks at the odors arising from the manure while the liquid dilution method is concerned with the odors in the manure or the odor potential of the manure. Odor was found to have a higher strength from mixed manure than from unmixed manure. Odors arising from diluted or 'liquid' manure have an odor strength comparable with the odors arising from undiluted manure. However, the quality of the odor from 'liquid' manure is very offensive compared with the ammonia-like odor from undiluted manure. Reduction in the moisture content of manure reduces the odor strength and the odor offensiveness. The odor strength for fresh manure by liquid dilution is a dilution of the order 1000. This value can increase to as high as 35,000 depending on conditions. Odor strength measurements by vapor dilution are only valuable for comparison purposes, since odor production flow rates are unknown values. (See also W72-05067) (Bundy-Iowa State)
W72-05069

ANALYSES OF GASES ENCOUNTERED IN A COMMERCIAL POULTRY HOUSE,
Cornell Univ., Ithaca, N.Y. Dept. of Food Science.
W. E. Burnett.
In: Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution. Final Report, New York State Dept. of Health, Division of Air Resources, Ithaca, New York, p 40-46, April 15, 1969. 1 tab, 30 ref.

Descriptors: *Farm wastes, *Poultry, Ammonia, Carbon dioxide, Hydrogen sulfide, Organic compounds, Odor, Air pollution, Sufur dioxide, Humidity, Temperature, *Air pollution.
Identifiers: Chemical detection.

Little is known about the concentration of gases in poultry houses. Past research has centered mainly on the ammonia and carbon dioxide levels in poultry confinement housing. Ammonia concentrations as high as 100 ppm have been found in some commercial poultry houses under the conditions of reduced ventilation and reuse of litter. Some factors which are believed to affect the concentration of gases in poultry buildings are temperature, humidity, ventilation, bird population and the manure management system, as well as frequency of waste removal. A number of existing techniques for the measurement of industrial air pollution are applicable to the analysis of gases encountered in commercial poultry houses. The wet chemical (absorption) method of gas detection was used to determine the concentrations of aliphatic aldehydes, hydrogen sulfide, sulfur dioxide and ammonia in a commercial poultry house with fluid waste handling. The average gas concentrations in ppm were 0.032, 6.98, 0.0036, and 1.13 for aliphatic aldehydes, hydrogen sulfide, sulfur dioxide, and ammonia respectively. None of the gas concentrations were above the maximum allowable concentration (MAC) for humans, but the level of H2S was well above its odor threshold of 0.13 ppm. As the concentrations of gases showed considerable variation from sampling to sampling, more work is needed to correlate gas concentrations with such factors as temperature, ventilation rate and manure management system. (See also W72-05067) (Bundy-Iowa State)
W72-05070

GASES AND ODORS FROM UNDILUTED AND DILUTED CHICKEN MANURE,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W72-05071

PARTICULATE MATTER,
Cornell Univ., Ithaca, N.Y. Dept. of Food Science.
W. E. Burnett.
In: Odors, Gases and Particulate Matter from High Density Poultry Management Systems as they Relate to Air Pollution. Final Report, New York State Dept. of Health, Division of Air Resources, Ithaca, New York, p 65-70, April 15, 1969. 1 tab, 10 ref.

Descriptors: *Farm wastes, *Odor, *Poultry, Gas chromatography, Circulation, *Air pollution.
Identifiers: Odor panel, *Particulate matter, Filter pads, Poultry dust.

Modern commercial high density poultry houses contain high concentrations of airborne particulate matter. Concentrations as high as 1.16 mg per cubic foot of air have been reported. Regarding quantities of particulates produced, amounts as high as 1 lb/day/1000 birds have been reported. The particulate matter consists of fecal matter, feed, feathers, and epidermal fragments, litter, and dust brought into the poultry house by the ventilation system. Particulate matter collected by high volume samplings of a commercial poultry house atmosphere revealed that the particulates carried a 'chicken house' odor. Gas chromatographic analyses of the volatiles carried by the particulates revealed the presence of individually odoriferous compounds. Large quantities of particulate matter are probably expelled from poultry houses by ventilation fans. Whether particulate matter plays a significant role in ambient odors from poultry houses should be investigated further since the particulates represent a retentive source of odors. (See also W72-05067) (Bundy-Iowa State)
W72-05072

AN IMPROVED DIANTHRIMIDE TECHNIQUE FOR THE DETERMINATION OF BORON IN RIVER WATERS,
Calgary Univ. (Alberta). Dept. of Geoogy.
A. A. Levinson.
Water Res. 5 (1): 41-42. 1971.
Identifiers: Boron, Determination, Dianthrimide, River, Technique.

A modified dianthrimide method is described which is capable of detecting as little as 0.01 mg l-1 B in river water. The procedure is based upon the use of calcium hydroxide to fix the B; this also permits rapid evaporation of the water sample without the loss of volatile borates.--Copyright 1971, Biological Abstracts, Inc.
W72-05109

THE ANALYSIS OF MERCURY IN URINE, BLOOD, WATER, AND AIR,
Olin Corp., New Haven, Conn.
Leonard A. Krause, Richard, Henderson, Henry P. Shotwell, and Dale A. Culp.
Amer Ind Hyg Ass J. 32 (5): 331-337. 1971. Illus.
Identifiers: Air, Blood, Mercury, Urine, Water.

A procedure for the analysis of Hg in water, air, and biological fluids is described. Sensitivity and reliability data are presented. The procedure is simple, fast, and reliable. It is a method which is adaptable to the analysis of Hg in any medium that lends itself to liquefication and/or the release of elemental Hg by aeration, and it is equally applicable as a permanent analytical system in the laboratory or in the field as a portable testing device.--Copyright 1971, Biological Abstracts, Inc.
W72-05113

BACTERIOLOGY OF MANGANESE NODULES: V. EFFECT OF HYDROSTATIC PRESSURE ON BACTERIAL OXIDATION OF MNII AND REDUCTION OF MNO2,
Rensselaer Polytechnic Inst., Troy, N.Y.
For primary bibliographic entry see Field 05C.
W72-05129

COMPARATIVE EVALUATION OF MEDIA FOR ISOLATING COLIFORM BACTERIA,
I. M. Gladkov, and M. I. Andreeva.
Lab Delo. 10. 637. 1970.
Identifiers: Bacteria, Bulirs, Coliform, Comparative, Escherichia-Coli, HB, Heifitz, Isolating, Kessler, Media, Medium.

A comparative study showed that when incubating Escherichia coli for 6 hr at 43 deg. the greatest number of microbes grows in Bulir's medium and slightly less in Heifitz' medium; the coliform developed less intensely in Kessler's and HB media.--Copyright 1971, Biological Abstracts, Inc.
W72-05189

HYPHOMICROBIA AND THE OXIDATION OF MANGANESE IN AQUATIC ECOSYSTEMS,
Tasmania Univ., Hobart (Australia). Dept. of Botany.
P. A. Tyler.
Antonie Leeuwenhoek J Microbiol Serol. 36 (4): 567-578. 1970. Illus.
Identifiers: Aquatic, Ecosystems, Hyphomicrobium, Hypomicrobia, Manganese, Oxidation.

Biogenic Mn deposits from freshwater pipelines in many parts of the world have been examined chemically and microbiologically. For chemical analysis to indicate the nature of the deposit the sampling procedure must ensure that the biogenic deposit is not contaminated by abiogenic material. Hyphomicrobium is abundant in manganese deposits from world-wide location but it is not the only manganese-oxidizing bacterium. The difficulties of assessing the relative importance of hyphomicrobia and other Mn bacteria, and of formulating satisfactory culture media, are discussed. Examination of accredited deposits and laboratory cultures suggests that some hyphomicrobia preferentially oxidize Mn rather than Fe.--Copyright 1971, Biological Abstracts, Inc.
W72-05197

COMPOSITION OF SURFACE WATERS OF NEW JERSEY IN RELATION TO SOIL SERIES: II. WATERS OF THE SOUTH BRANCH: RARITAN RIVER, STONY BROOK, NESHANIC RIVER AND ASSUMPINK CREEK,
Rutgers - The State Univ., New Brunswick, N.J. Coll. of Agriculture and Environmental Science.
Arthur N. Ott, and Stephen J. Toth.
Bull N J Acad Sci. 15 (1/2): 13-19. 1970.
Identifiers: Assumpink, Branch, Brook, Composition, Creek, Fish, Minerals, Neshanic, New-Jersey, Pollution, Production, Raritan, Relation, River, Series, Soil, South, Stony, Surface.

Waters of 4 streams in Central New Jersey, South Branch of the Raritan River, Stony Brook, Neshanic River, and Assumpink Creek, were analyzed during the spring and summer flow periods in an attempt to relate water composition to soil series variations. The influence of soil series variations was marked to a large extent by contributions from soil liming and fertilization practices as well as by domestic and industrial pollution. Waters of central New Jersey were found to be lower in Ca and Mg and higher in Na, K, and heavy metal contents than waters of northern New Jersey. The Ca contents ranged from 5.4 to 17.5 ppm and the K contents ranged from 0.9 to 2.1 ppm. Examination of the watershed area of Assumpink Creek indicated that the waters of the tributaries are low in bases and high in heavy metals except when heavily polluted. The establishment of impoundments in the upper reaches of this stream will require liming and phosphating of the waters to insure satisfactory water quality for fish production.--Copyright 1971, Biological Abstracts, Inc.
W72-05198

LIMNOLOGICAL STUDIES IN BELGIUM: VI. THE MEANDERS OF THE DURME RIVER AT HAMME (EAST FLANDERS PROVINCE),
Institut Royal des Sciences Naturelles de Belgique, Brussels.
Ludo Van Meel.
Bull Inst Roy Sci Natur Belg. 46 (13): 1-56. 1970. Illus.
Identifiers: Belgium, Chlorobacteriaceae, Chlorophyll, Chlorophyta, Chrysophyta, Durme, East, Flanders, Hamme, Limnological, Meanders, Minerals, Phyto, Plankton, Province, River.

The Durme River once formed so many meanders between Hamme and Waasmunster that the river had to be straightened to increase flow speed and to facilitate navigation. In this study, the ecological characteristics and phytoplankton of the waters of these now-abandoned meanders were investigated monthly at 2 locations from 1965-1966. Geochemically, the water is hexaionic with 3 anions and 3 cations. The following elements were regularly determined: pH, alkalinity, chlorides, sulfates, nitrates, phosphates and silicates, Mg, Na, and K. The saturation of dissolved O2, oxidability (organic matter), and carbohydrates were also studied. Following extraction, the chlorophyll of the phytoplankton was determined. Definite, periodic correlations were shown between the variations in the chemicals dissolved in the water and the chlorophyll. These correlations were especially concerned with the carbonic acid-calcium-chlorophyll relationship, the supersaturation of O2 and the production of chlorophyll, the nitrates and phytoplankton, and the pumping out of phosphates by zooplankton. Several maximums and a very pronounced minimum in Jan. 1966 were noted in the chlorophyll and corresponded to Chlorophyta and Chrysophyta maximums. Monthly distribution research showed that the greatest number of different species were found during July and Aug. The chlorophyll maximum did not always correspond to a maximum in formed phytoplankton elements; this showed that there was probably interference by the chlorophyll of the Chlorobacteriaceae. The periods of a zooplankton maximum corresponded to the periods of a phosphate minimum. Twenty-two spp. found in 1939-1941 were not found to be present in 1965-1966.--Copyright 1971, Biological Abstracts, Inc.
W72-05210

VIROLOGICAL SURVEYS OF THE PRESENCE OF ENTEROVIRUSES IN WASTE WATER: I. INCIDENCE OF POLIO-VIRUSES IN PRAGUE AT THE END OF 1963 AND IN 1969, (IN CZECH),
Ustav Epidemiologie a Mikrobiologie, Prague (Czechoslovakia).
For primary bibliographic entry see Field 05B.
W72-05226

QUANTITATIVE CHARACTERIZATION OF THE MEANS OF STRONTIUM-90 INTAKE INTO THE BODY OF GASTROPODS, (IN RUSSIAN),
Institute of Biology of the Southern Seas, Sevastopol (USSR).
V. M. B. Nyanishkene, and G. G. Polikarpov.
Radiobiologiya. 10 (6): 928-930. 1970.
Identifiers: Body, Elodea-Canadensis-M, Gastropods, Intake, Limnes-Stagnalis, Quantitative, Strontium-90.

Limnea stagnalis was studied in mo.-long experiments. The deposition of Sr90 absorbed from the water was 100% greater in the body of the mollusk and 200% greater in the shell than that absorbed from the food (Elodea canadensis).--Copyright 1971, Biological Abstracts, Inc.
W72-05227

PHYTOPLANKTON AND HYDROGRAPHY OF THE BAY OF CADIZ IN 1969, (IN SPANISH),
Instituto de Investigaciones Pesqueras, Cadiz (Spain).
Rafael Establier.
Invest Pesq. 34 (2): 515-528. 1970. Illus. (English summary).
Identifiers: Bay, Biomass, Cadiz, Hydrography, Phyto, Pigments, Plankton, Plant, Salinity, Spain, Temperature.

Temperature, salinity plant pigments and computed biomass are plotted. These results are based on fortnightly observations in 4 stations. The results of spectrophotometric analysis of filtered seston are summarized.--Copyright 1971, Biological Abstracts, Inc.
W72-05254

HYDROGRAPHIC RESEARCH STUDIES OF CORONA DEL LAGO FUSARO (NAPLES), (IN ITALIAN),
Naples Zoological Station (Italy).
For primary bibliographic entry see Field 02L.

W72-05255

AN EMPIRICAL METHOD FOR DETERMINING THE CONCENTRATION OF SOLIDS IN SUSPENSION,
American Standard Inc., New Brunswick, N.J.
J. W. Liskowitz.
Environmental Science and Technology, Vol 5, No 12, p 1206-1211, December 1971. 11 fig, 2 tab, 21 ref.

Descriptors: *Hydrosols (Dispersions), *Polarographic analysis, *Monitoring, Optical properties, Suspended load, Analytical techniques, Water pollution.
Identifiers: Depolarization, Suspended solids.

An optical method for measuring the mass concentration of suspended solids in hydrosols could provide a rapid and continuous technique for monitoring water pollution. The degree of depolarization of back-scattered polarized radiation by model hydrosol systems was investigated and an empirical method for determining suspended solids concentrations was established. Results show that the degree of depolarization is related to the volume concentration of suspended solids. The degree of depolarization increases with the refractive index ratio of the solid to the dispersing medium at values below 1.38 and remains constant in the 1.38 to 1.82 range. The degree of depolarization increases with the optical path length, but this increase is limited by the concentration of the solids and refractive index ratio of the suspension. The degree of depolarization is a single valued function with respect to concentration and is unaffected by such factors as particle shape, optical activity, and the solid deposits on the optical windows. This approach responds to a greater concentration range of particles and is less dependent on particle size than the commonly used transmission and light-scattering techniques. (Mortland-Battelle)
W7204731

5B. Sources of Pollution

DDT IN FOREST STREAMS,
Chemical Control Research Inst, Ottawa (Ontario),
W. N. Yule, and A. D. Tomlin.
Bulletin of Environmental Contamination and Toxicology, Vol 5, No 6, p 479-488, November/December 1971. 1 fig, 3 tab, 20 ref.

Descriptors: *DDT, *Sediments, *Pesticide residues, *Water analyses, Watersheds (Divides), Pesticides, Tributaries, Pesticide toxicity, Gas chromatography, Analytical techniques, Fishkill, Chlorinated hydrocarbon pesticides, Path of pollutants, Surface runoff, Estuaries.
Identifiers: *DDE, *DDD, pp'DDT, New Brunswick, Choristoneura fumiferana, St. John River, Restigouche River, Miramichi River, Phosphamidon, Fenitrothion, Crooked Bridge Brook, Big Hole Brook, Miramichi Estuary, op'DDT, pp'DDE, pp'DDD, Metabolites.

Water and sediment samples from a tributary of the Miramichi River (New Brunswick) were studied before, during, and up to 2 years after the final application of DDT to an area of forest under attack by Spruce budworm. Petroleum ether extracts of water samples and bottom sediment samples extracted into hexane-acetone were analyzed by gas chromatography. Analyses showed that only during and for a few hours after spray application did the DDT concentration in the stream surface waters exceed the steady level of 0.5 ppb pp'DDT (less than 17 ppb). This DDT flush occurred mainly as a surface film associated with the oil used for air spray formulation. Sediment analyses showed a downstream dilution gradient of DDT from tributary to estuary. These sediments averaged only 12.5 percent of the DDT concentration found in the soils of surrounding forests. Much of the pp'DDT sprayed was decomposed to DDE and DDD in the bottom sediments of the forest streams. (Holoman-Battelle)

W72-04719

METALS FOCUS SHIFTS TO CADMIUM.

Environmental Science and Technology, Vol 5, No 9, p 754-755, September 1971.

Descriptors: *Toxicity, *Water pollution sources, *Water pollution effects, Diseases, Heavy metals.
Identifiers: *Cadmium.

Cadmium has long been known to be dangerous to man but there has been little definitive data on its effects or on its distribution in the environment. It is known to have a very long biological half-life in man, from 10-25 years, and can thus have a cumulative effect. It is also known to cause severe liver and kidney damage, pulmonary disease, and has been associated with osteomalacia in Japan. The amounts needed to provide these effects are not known. Many recent studies have provided a fairly complete picture of the sources and amounts of emission into the atmosphere. However, little is yet known about concentrations in water supplies. Findings have shown that many municipal water supplies contain more than the 0.1 ppm of cadmium considered safe for drinking. Although cadmium is a potentially dangerous pollutant and studies are needed to determine effects, sources, concentrations, and controls, there is presently no cadmium crisis. (Mortland-Battelle)
W72-04727

DISTRIBUTION OF BLUE-GREEN ALGAL VIRUSES IN VARIOUS TYPES OF NATURAL WATERS,
Delaware Univ., Newark. Dept. of Biological Sciences.
M. S. Shane.
Water Research, Vol 5, No 9, p 711-716, September 1971. 1 fig, 3 tab, 10 ref.

Descriptors: *Viruses, *Cyanophyta, *Distribution patterns, *Water analysis, *Bioindicators, Algae, Rivers, Streams, Delaware River, Oxidation lagoons, Ponds, Farm ponds, Maryland, Quarries, Ohio River, Hudson River, Indicators, Delaware, Path of pollutants, Hosts, Pennsylvania, New York, New Hampshire, Ohio, Michigan.
Identifiers: *LPP virus, *Blue-green algal viruses, *Plectonema boryanium, Susquehanna River, Brandywine River, Red Clay River, White Clay River, Christina River, Big Elk River, Little Elk River, Octorara River, Plectonema, Lyngbya, Phormidium, Cyanophyceae, Oscillatoriaceae, Schizothrix calcicola, Elkton Pond, Rising Sun Pond, Industrial storage tanks.

A survey was conducted in the Delaware-Maryland area to ascertain the distribution of LPP blue-green algal viruses in all types of natural waters. Their presence was determined on the basis of the ability of samples to produce lysis in cultures of the algal test organism, Plectonema boryanum (UI581), and to form plaques on the host algal lawn using the soft-agar technique of Safferman and Morris. The viral concentration was determined by the direct count of the number of plaques formed per ml of water sample. The viral strain, LPP-1, was determined for selected viral cultures isolated from the Christina, Red Clay, and White Clay Rivers and the Elkton and Rising Sun Oxidation Ponds. LPP-viruses existed in every type of water. The oxidation ponds gave the highest percentage of samples containing at least one virus and the highest concentration of viruses. All reservoirs and industrial storage tanks which contained viruses had influents which also contained viruses. Test data on the rivers showed these viruses present in most streams. The viruses were consistently absent from the headwaters of the three rivers listed above but increased as these rivers flowed through more populated areas. The headwaters for all three are in low population density and rural environments. It is suggested that the algal hosts of these viruses thrive in areas of high organic material such as may be associated with pollution. Tables show the distribution and incidence of the LPP-viruses in the waters. (Holoman-Battelle)
W72-04736

DIELDRIN LEVELS IN FISH FROM IOWA STREAMS,
Iowa Univ., Iowa City. State Hygienic Lab.
For primary bibliographic entry see Field 05A.
W72-04739

EXPANDED PROGRAM FOR PESTICIDE MONITORING OF FISH,
Bureau of Sport Fisheries and Wildlife, Washington, D.C.
For primary bibliographic entry see Field 05A.
W72-04740

CHLORINATED HYDROCARBON PESTICIDES IN IOWA RIVERS,
Iowa Univ., Iowa City. State Hygienic Lab.
L. G. Johnson, and R. L. Morris.
Pesticides Monitoring Journal, Vol 4, No 4, p 216-219, March 1971. 4 tab, 9 ref.

Descriptors: *Dieldrin, *Surface runoff, *Chlorinated hydrocarbon pesticides, DDT, River basins, Watersheds, Agricultural chemicals, Pesticides, Sampling, Gas chromatography, Water pollution effects, Water pollution sources, Pesticide residues, Turbidity, Rivers, Fish, Catfishes, Path of pollutants, *Iowa, Mississippi River, Missouri River, Heptachlor.
Identifiers: DDE, Seasonal variation, Metabolites, Cedar River, Iowa River, Raccoon River, Little Sioux River, Nishnabotna River, Skunk River.

Chlorinated hydrocarbon pesticides, dieldrin, DDT, and DDE, used in corn insect control were monitored in Iowa rivers during 1968, 1969, and 1970. Water samples from six to ten sites were identified and quantitatively analyzed by gas chromatography. The level of pesticide residues in the rivers varied from year to year, from season to season, and from river to river depending on the amount of surface runoff water entering the river, the amount of insecticides used by agriculture, especially in the spring, and the location of the river relative to agricultural areas. The principal residue found was dieldrin which resulted from agricultural use of aldrin. Detailed data on pesticide concentrations are included. (Jefferis-Battelle)
W72-04753

AGRICULTURAL POLLUTION OF THE GREAT LAKES BASIN.

Copy available from GPO Sup Doc, $1.50, microfiche from NTIS as PB-206 906, $0.95. Environmental Protection Agency, Water Quality Office, Combined report by Canada and the United States, July 1971. 185 p, 16 fig, 50 tab, 22 ref. EPA Program 13020–07/71.

Descriptors: *Agriculture, *Water pollution control, *Great Lakes, *Farm wastes, Land use, Management, Fertilizers, Pesticides, Phosphorus, Water pollution sources, Nitrogen, Erosion, Chlorides, Standards, Legislation, Sedimentation, Forests, Planning, United States, International Joint Commission, Herbicides, Runoff, Sedimentation, Methodology, Waste water (Pollution).
Identifiers: Canada, State-of-the-art.

This report concerns pollution abatement in the Great Lakes Basin, specifically influenced by agricultural and related sources, including runoff and release of nutrients, pesticides, herbicides, and degradation by-products as affected by agricultural chemicals, runoff from animal and poultry production, and sedimentation. Current planning, advisory and regulatory functions of the two Governments is discussed. Some basic research of the joint study-group is summarized. Nitrogen contributions from cropland to water

supplies cannot be accurately estimated. An accurate estimate of the proportion of phosphorus from fertilizers reaching the lakes is currently impossible but it is fairly clear that approximately 12% comes from fertilizers via land drainage. Improper manure spreading or storing, and runoff from livestock feeding areas have the greatest potential impact on water quality. Pesticide contribution to environmental contamination is receiving closer scrutiny. The little herbicide research in Ontario suggests that only a remote possibility exists that significant amounts of herbicides reach the Lakes. The erosion problem is being measured in sediment load in streams and deposition rate in reservoirs. High chloride levels, measured in tributary waters, seem related to road salt application. The adequacy of current legislation is discussed. (Jones-Wisconsin)
W72-04762

PHOSPHATE EQUILIBRIA ON STREAM SEDIMENT AND SOIL IN A WATERSHED DRAINING AN AGRICULTURAL REGION,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 05C.
W72-04774

AN INTERSECTORAL PROGRAMMING MODEL FOR THE MANAGEMENT OF THE WASTE WATER ECONOMY OF THE SAN FRANCISCO BAY REGION,
Technion-Israel Inst. of Tech., Haifa. School of Engineering.
J. S. Bargur, H. C. Davis, and E. M. Lofting.
Water Resources Research, Vol 7, No 6, p 1393-1409, December 1971. 14 tab, 19 ref, 1 append.

Descriptors: *Estuarine environment, *Input-output analysis, *Linear programming, *Water quality control, Waste water disposal, Effluents, Water treatment, Pollution, California.
Identifiers: *San Francisco Bay, Interindustry models, Intersectoral models.

The objective was to unify various factors bearing on the management of estuarine water quality into an operational analytical technique. Specifically, the problem had two major aspects: (1) a clear analysis of the industrial structure of the surrounding region and the economic interrelationships of the major sectors generating waste water and (2) a dispersion model for the estuary in which the well defined mixing and diffusion patterns of pollutants could be traced. An input-output model of the San Francisco Bay economy was proposed along with a linear programming model for water quality management. Two programs for treatment cost minimization were proposed with the following results. Only a few industries were required to treat their effluent. The results of the model that incorporated domestic effluent supported the view that industrial wastes in the San Francisco Bay posed the more serious problems for maintaining water quality. Once an industry was expected to treat its effluent, the optimal solutions of the models advocated full treatment. Within the linear programming framework, delta flushing could easily be evaluated. (Ligon-Cornell)
W72-04780

THE IMPACT OF VARIOUS HEAVY METALS ON THE AQUATIC ENVIRONMENT,
Environmental Protection Agency, Denver, Colo. Water Quality Office.
R. F. Schneider.
Environmental Protection Agency Water Quality Office Technical Report No 2, February 17, 1971, 22 p. 5 tab, 29 ref.

Descriptors: *Heavy metals, *Water pollution effects, *Water quality, *Aquatic environment, *Standards, Administrative agencies, Water chemistry, Arsenic compounds, *Copper, Solubility, Publications, Information retrieval.
Identifiers: *Literature review, *Cadmium, *Lead, *Zinc.

A literature review of the effects of arsenic, copper, cadmium, lead, and zinc species on water quality and aquatic biota is presented. Some synergistic and antagonistic effects are discussed and the existing governmental standards for these metals are summarized. Tables are given for each of the heavy metals showing the different concentrations in mg/liter, the names and dates of organizations making recommendations, and brief comments. (Lang-USGS)
W72-04792

SOLUBILITY OF BARIUM AND STRONTIUM SULFATES IN STRONG ELECTROLYTE SOLUTIONS,
Bureau of Mines, Bartlesville, Okla. Bartlesville Petroleum Research Center.
For primary bibliographic entry see Field 05G.
W72-04793

ORGANOCHLORINE INSECTICIDE RESIDUES IN EVERGLADES NATIONAL PARK AND LOXAHATCHEE NATIONAL WILDLIFE REFUGE, FLORIDA,
Geological Survey, Miami, Fla. Water Resources Div.
M. C. Kolipinski, A. L. Higer, and M. L. Yates.
Pesticides Monitoring Journal, Vol 5, No 3, p 281-288, December 1971. 1 fig, 8 tab, 22 ref.

Descriptors: *Water pollution sources, *Insecticides, *DDT, *Pesticides, *Florida, Data collections, Monitoring, Surface waters, Soils, Crops, Mosquitoes, Chemical analysis.
Identifiers: *Everglades (Fla).

The Water Resources Division of the U.S. Geological Survey has field programs for monitoring environmental concentrations of selected organochlorine insecticides in the Everglades of south Florida. Water in Everglades National Park and Loxahatchee National Wildlife Refuge contained DDT and its metabolites DDD and DDE in the range 0.00 to 0.03 micrograms/liter. Some samples of soils underlying marshes had concentrations of the DDT family as much as three orders of magnitude greater than the concentrations found in water. Algal mats, omnivorous marsh-dwelling crustaceans, and marsh fishes showed concentrations of the DDT compounds up to three or four orders of magnitude greater than traces found in water. DDT and its metabolites were found more frequently than other organochlorine insecticides in the materials examined. Residues come from transport mechanisms such as surface water inflow and aerial transport, the latter consisting of direct particulate fallout and precipitation. (Woodard-USGS)
W72-04799

PROBABLE IMPACT OF NTA ON GROUND WATER,
Robert S. Kerr Water Research Center, Ada, Okla.
W. J. Dunlap, R. L. Cosby, J. F. McNabb, B. E. Bledsoe, and M. R. Scalf.
Ground Water, Vol 10, No 1, p 107-117, January-February 1972. 15 fig, 3 ref.

Descriptors: *Detergents, *Water pollution sources, *Path of pollutants, *Nitrates, Organic compounds, Ion transport, Leaching, Groundwater movement.
Identifiers: *Nitrilotriacetic acid.

Laboratory studies were employed to investigate the fate and effect of NTA both in groundwaters and in soil profiles overlying groundwaters. Sorption of NTA on soils could slow its movement into and through groundwaters. Sorption will probably not prevent or greatly reduce potential pollution of groundwater by NTA used as a detergent builder. NTA infiltrating through most unsaturated soils likely would undergo rapid and complete degradation and contribute only inorganic nitrogen compounds and carbonate to groundwaters; NTA infiltrating through saturated soils would probably experience only very limited degradation, with a major portion entering groundwater intact; any NTA which escaped degradation during infiltration through soils could transport such metals as iron, zinc, chromium, lead, cadmium, and mercury from soils into groundwaters. NTA would likely undergo slow degradation in essentially anaerobic groundwater environments, with production of CO2, CH4, and possibly other organic compounds. (Knapp-USGS)
W72-04800

SALTY GROUND WATER AND METEORIC FLUSHING OF CONTAMINATED AQUIFERS IN WEST VIRGINIA,
Environmental Protection Agency, Wheeling, W. Va.
B. M. Wilmoth.
Ground Water, Vol 10, No 1, p 99-105, January-February 1972. 8 fig, 6 ref.

Descriptors: *Water pollution sources, *Saline water, *West Virginia, *Saline water intrusion, Industrial wastes, Salts, Deicers, Oil fields, Brines, Path of pollutants, Leaching, Water pollution control.
Identifiers: Highway deicing.

Salty groundwater is commonly encountered at relatively shallow depths of 100 to 300 feet beneath the major stream channels in the western half of West Virginia. It is difficult to distinguish natural contamination from that caused by industrial activities. Histories of some water well developments show large-scale changes in salt content from various industrial activities that affect the fresh water zones. Heavy pumping of well fields in Charleston during 1930 to 1956 accelerated migration upward of salt water. Pumpage has declined greatly since 1956 and chloride content has decreased below 200 mg/l at some of the contaminated wells. Road salt piles contaminated a carbonate aquifer in Monroe County. Chloride concentrations in wells located 1,500 feet from the piles increased from 185 mg/liter to 1,000 mg/liter in 5 years. The greatest change was 1,000 mg/liter in 1969 to 7,200 mg/liter in 1970 when the salt storage area was enlarged. All salt piles were removed in late 1970 and within 2 months chloride content decreased to 188 mg/liter. (Knapp-USGS)
W72-04801

THE USE, ABUSE AND RECOVERY OF A GLACIAL AQUIFER,
Williams and Works, Grand Rapids, Mich.
E. M. Burt.
Ground Water, Vol 10, No 1, p 65-71, January-February 1972. 9 fig, 1 tab.

Descriptors: *Great Lakes Region, *Water pollution control, *Groundwater, *Aquifers, *Water resources development, Glacial drift, Alluvium, Water pollution sources, Water pollution effects, Industrial wastes, Domestic wastes, Michigan.

The interrelationships between an industrial plant and a shallow sand aquifer of glacial origin are described. These relationships include industrial and potable water supplies, industrial and human waste water disposal systems, the hydraulics of the pollution of the groundwater aquifer and the types of corrective actions taken to re-establish the wise use of the ground-water resource. Also reviewed are the ground-water movement-quality relationship, well designs, method of drilling, well redevelopment and ground-water recharge. (Knapp-USGS)
W72-04802

METHODS OF GEOLOGIC EVALUATION OF POLLUTION POTENTIAL AT MOUNTAIN HOMESITES,
Colorado State Univ., Fort Collins. Dept. of Geology.
J. P. Waltz.
Ground Water, Vol 10, No 1, p 42-47, January-February 1972. 7 fig, 1 tab, 4 ref.

Descriptors: *Septic tanks, *Soil disposal fields, *Colorado, *Path of pollutants, *Water pollution sources, Domestic wastes, Waste treatment, Water pollution control, Hydrogeology, Groundwater movement, Fractures (Geology).

Development of mountain homesites is accelerating in the Rocky Mountains of central Colorado. These homesites often require individual water wells and sewage disposal systems. Unfortunately, the widely used septic tank leach field system generally is not suited for use in the mountainous terrain where soils are thin or missing. Sewage effluent at these sites may directly enter bedrock fractures and travel large distances without being purified. As a consequence, contamination of streams, lakes, and groundwater from these malfunctioning leach fields has become a problem. Criteria were developed for evaluating pollution potential at mountain homesites. Contamination of water wells may be decreased significantly where geologic conditions are considered in the selection of sites for leach fields and wells. The orientation of jointing surfaces in the bedrock significantly affects the travel path of contaminants. (Knapp-USGS)
W72-04803

THERMAL STUDY OF THE MISSOURI RIVER IN NORTH DAKOTA USING INFRARED IMAGERY,
Geological Survey, Bismarck, N. Dak.
O. A. Crosby.
Geological Survey Open-file Report, 1971. 46 p, 13 fig, 3 ref, 2 append.

Descriptors: *Water pollution sources, *Thermal pollution, *Nuclear powerplants, *Remote sensing, Missouri River, North Dakota, Infrared radiation, Aircraft, Streamflow, Path of pollutants.
Identifiers: *Infrared imagery.

Infrared imagery obtained from aircraft at 305-to 1,524-meter altitudes was used in monitoring thermal changes attributable to the operation of thermal electric plants on the Missouri River in North Dakota. There was a marked decrease in water temperature in the Missouri River prior to early fall and a moderate increase in temperature in late fall because of the Lake Sakakawea impoundment. At the present time, thermal additions generated by the powerplants have little effect on the temperature regimen of the Missouri River at high rates of river discharge. (Woodard-USGS)
W72-04824

GUIDELINES: BIOLOGICAL SURVEYS AT PROPOSED HEAT DISCHARGE SITES,
Pacific Northwest Water Lab., Corvallis, Oreg.
For primary bibliographic entry see Field 05G.
W72-04828

COMPARATIVE STUDIES OF PEPTONE DEGRADATION AND THE CORRELATED POPULATION OF CILIATES IN MODELS OF FLOWING AND STAGNANT WATER,
Bonn Univ. (West Germany). Zoological Inst.
For primary bibliographic entry see Field 05C.
W72-04909

210POO2 MOVEMENT IN A MOUNTAIN WATERSHED SOIL,
Colorado State Univ., Fort Collins. Dept. of Radiology and Radiation Biology.
W. R. Hansen, R. L. Watters, and N. D. Yaney.
Health Phys. 20 (4): 425-429. 1971. Illus.
Identifiers: Contamination, Di, Equations, Melt, Mountain, Mountains, Movement, Oxide, Polonium-210, Retention, Rocky, Snow, Soil, Stream, Watershed.

Uniform contamination of a Rocky Mountain watershed with 210PoO2 from a SNAP (Systems for Nuclear Auxiliary Power) generator would find the major contamination retained by the soil. A simulated snow-melt run-off experiment was conducted with a mountain Podzol soil from the Fraser Alpine Area, Colorado. 210PoO2 was applied to the litter layer as a point source 1 m. from water collection vessels at the base of a 30% slope. Cores from the soil on which 1 mean annual rainfall (18.6 in.) of ice was melted indicated both vertical and horizontal movement of 210PoO2 into the soil. The run-off water collected at the base of the slope at the bottom of the litter layer and A2 horizon indicated on 10 to the minus 7th power of the original activity moved through these soil horizons. Data from soil cores were used to predict the movement of a uniform deposition of 210PoO2 to a stream. The equations derived indicate only the 1st 50 cm bordering a stream contribute significant contamination to the water.--Copyright 1971, Biological Abstracts, Inc.
W72-04920

PERSISTENCE OF PESTICIDES IN RIVER WATER,
Environmental Protection Agency, Cincinnati, Ohio. Water Quality Office.
James W. Eichelberger, and James J. Lichtenberg.
Environ Sci Technol. 5 (6): 541-544. 1971.
Identifiers: Azodrin, Baygon, BHC, Carbamate, Chlor, Chlorine, DDD, DDE, DDT, Dieldrin, Endrin, Epoxide, Hepta, Organo, Pesticides, Phosphorus, River.

The persistence of 28 common pesticides in raw river water was studied over an 8-wk-period. Twelve organochlorine, 9 organophosphorus, and 7 carbamate pesticides were studied at a concentration of 10 microgram/l. No measurable degradation or chemical change was observed for the following organochlorine compounds: BHC, heptachlor epoxide, dieldrin, DDE, DDT, DDD, and endrin. Azodrin was the only organophosphorus compound that was stable throughout the study. All carbamate compounds were significantly changed after 1 wk, and all but Baygon were completely lost after 8 wk. Where possible, the degradation or chemical conversion products of the pesticides were identified.--Copyright 1971, Biological Abstracts, Inc.
W72-04922

BORDEAUX: STUDY OF ATMOSPHERIC POLLUTION ON THE BUILT-UP AREA,
Bordeaux (France).
J. G. Faugere.
Identifiers: Ash, Atmospheric, Bordeaux, Built-Up, Carbon, Chlorides, Computer, France, Mon, Oxide, Particulates, Pollution, Processing, Rain, Sodium, Tar.

Results obtained on analyses of CO from rainwater samples are discussed. Relationships between the CO content, local meteorological conditions, and traffic are given. The analyses made on rain water show a certain parallelism between the height of water, the matter in solution, the chlorides and sodium. Considerable variations in content of insoluble matter, ash and tar were apparent. Results of the analyses together with the meteorological findings were processed for the computer.--Copyright 1971, Biological Abstracts, Inc.
W72-04923

CHONDROCOCCUS COLUMNARIS DISEASE OF FISHES: INFLUENCE OF COLUMBIA RIVER FISH LADDERS,
Battelle Memorial Inst., Richland, Wash.
M. P. Fujihara, and F. P. Hungate.
J Fish Res Bd Can. 28 (4): 533-536, 1971.
Identifiers: Chondrococcus-Columnaris, Coho, Columbia, Disease, Fish, Fishes, Incidence, Infection, Ladders, River, Salmon.

Columbia River fish ladders were surveyed as a possible ecological niche for C. columnaris, the causative agent for columnaris disease of fishes. Water samples from Bonneville, McNary, Priest Rapids, and Rocky Reach fish ladders during periods of warm-water temperature and high population density of fishes showed C. columnaris levels of from 0.06 to 4.1 organisms/ml. Samples taken upstream or downstream from the ladders were consistently negative. Average agglutinating titers and incidence of C. columnaris infection in largescale suckers were higher at the Bonneville ladder than at a site several miles downstream. Coho salmon from an upper-river fish ladder (Rocky Reach) showed a higher incidence of infection and greater antibody production than at the downriver Bonneville ladder. It is concluded that fish-ladder facilities on the Columbia River are important sites for repetitive exposure of anadromous salmonids to C. columnaris.--Copyright 1971, Biological Abstracts, Inc.
W72-04959

NUTRIENTS AND CARBON DIOXIDE IN THE COLUMBIA RIVER,
Oregon State Univ., Corvallis. Dept. of Oceanography.
P. Kilho Park, Magdalena Catalfamo, George R. Webster, and Barry H. Reid.
Limnology and Oceanography, Vol 15, No 1, January 1970, p 70-79. 5 fig, 3 tab, 12 ref. Nat'l. Science Foundation Grants GP-2232, GP-2876 and GP-5317.

Descriptors: *Columbia River, *Carbon dioxide, *Nutrients, Sampling, Monitoring, Nitrates, Phosphates, Silicates, Diffusion, Alkalinity, Hydrogen ion concentration, Calcium carbonate, Saturation, Analytical techniques, Path of pollutants, Pollutant identification.

1-LITER SURFACE WATER SAMPLES WERE COLLECTED FROM THE Columbia River in the middle of each month from December 1965 to January 1967. Samples were analyzed, unfiltered, as soon as possible for phosphate, nitrate, reactive silicate, alkalinity, total CO2, and pH. Samples were refrigerated during storage, which was less than 2 days. All nutrients monitored showed a strong seasonal dependency, with low concentrations during the summer months and high concentrations during the winter months. While there existed an inverse relationship between stream flow rate and nutrient concentrations, alkalinity and total CO2 along the main stream were essentially constant. During 1966, 1.8 x 10 to the 14th power liters of water; 8.3 x 10 to the 7th power, 21. x 10 to the 6th power and 2.7 x 10 to the 10th power moles of phosphate, nitrate, and reactive silicate; 1.9 x 10 to the 11th power equivalents of alkalinity; and 1.9 x 10 to the 11th power moles of total carbon dioxide passed through Clatskanie, 87 km above the mouth of the Columbia River into the Astoria estuary and the Pacific Ocean. At Clatskanie, the nitrate: phosphate ratio is 3:1 during summer months, and over 19:1 at other seasons. Bicarbonate ion was the major dissolved carbon dioxide species in the entire Columbia River system, where water pH measured at 20 deg C ranges from 6.63 to 8.68. The major portion of the river system is undersaturated with respect to calcite solubility. Along the main stream, the river is supersaturated with respect to the atmospheric carbon dioxide pressure of 320 ppm. (Lowry-Texas)
W72-04974

LIMNOLOGICAL STUDIES OF THE LAKES AND STREAMS OF THE UPPER QU,APPELLE RIVER SYSTEM, SASKATCHEWAN, CANADA: I. CHEMICAL AND PHYSICAL ASPECTS OF THE LAKES AND DRAINAGE SYSTEM,
Univ. Saskatchewan, Saskatoon, Sask., Can. Biol. Dep.
For primary bibliographic entry see Field 05C.
W72-04975

IDENTIFICATION OF FILAMENTOUS MICROORGANISMS IN ACTIVATED SLUDGE,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
G. J. Farquhar, and W. C. Boyle.

Journal Water Pollution Control Federation, Vol 43, No 4, April 1971, p 604-622. 6 fig, 25 ref.

Descriptors: *Activated sludge, *Systematics, *Microorganisms, Lipids, Manganese, Sulfur, Iron, Oxidation, Analytical techniques, Waste water treatment, Biological treatment.
Identifiers: *Sludge bulking, *Filamentous microorganisms, Pure cultures, Mixed cultures, Identification techniques, Sheath material, Staining, Iron deposition.

Many organisms of interest in biological waste treatment either cannot be grown in pure culture, or undergo severe morphological changes when cultured on synthetic media. The techniques of bright contrast phase microscopy and additional methods to demonstrate types of sheath material, iron oxidation and deposition, sulfide oxidation, intracellular sulfur deposition and other intracellular inclusions were used to investigate and identify several filamentous microorganisms in mixed culture. Results of the analysis included compilations of facts about the appearance and the physiology of each filamentous microorganism. Attempts were made only to identify the genus to which a particular microorganism belonged, and a systematic key for the identification of microorganisms of this type is presented. (Lowry-Texas)
W72-04984

STRONTIUM-90, STRONTIUM AND CALCIUM IN SOME AQUATIC ORGANISMS FROM THE SEA OF OKHOTSK, (IN RUSSIAN),
Institute of Biology of the Southern Seas, Sevastopol (USSR).
For primary bibliographic entry see Field 05A.
W72-04999

THE RATE OF NUTRIENT RELEASE FROM GRASS AND DUNG FOLLOWING IMMERSION IN LAKE WATER,
Chancellor Coll., Limbe (Malawi).
For primary bibliographic entry see Field 02H.
W72-05020

RECURRENCE RELATIONS FOR FIRST ORDER SEQUENTIAL REACTIONS IN NATURAL WATERS,
Manhattan Coll., Bronx, N.Y. Environmental Engineering and Science Program.
D. M. Di Toro.
Water Resources Research, Vol 8, No 1, p 50-57, February 1972. 7 ref, 4 append. FWQA supported.

Descriptors: *Water chemistry, *Chemical reactions, Water quality, Aqueous solutions, Biodegradation, Biochemical oxygen demand, Dissolved oxygen, Thermodynamics.
Identifiers: Chemical kinetics.

The kinetics of many biologically and chemically reactive substances in natural waters can be approximated by first order reactions. A recurrence formula relates the concentrations in the sequence to the concentration distribution of the first reactant in the sequence. This recurrence relation applies to general spatial and temporal regimes. In particular, the recurrence relation immediately extends the known analytical solutions for a single first order reacting substance to any sequentially reacting set of substances for various spatial and temporal settings. This increase in the applicability of known solutions renders previously difficult problems soluble. (Knapp-USGS)
W72-05027

EFFECTS OF URBANIZATION ON STORM WATER RUNOFF QUALITY: A LIMITED EXPERIMENT, NAISMITH DITCH, LAWRENCE, KANSAS,
Kansas State Geological Survey, Lawrence.
For primary bibliographic entry see Field 04C.
W72-05035

APPLICATION OF STREAM ORDER NUMBERS TO THE MERRIMACK RIVER BASIN,
Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
For primary bibliographic entry see Field 04A.
W72-05036

EFFECT OF UPWELLING, MIXING, AND HIGH PRIMARY PRODUCTIVITY ON CO2 CONCENTRATIONS IN SURFACE WATERS OF THE BERING SEA,
Alaska Univ., College. Inst. of Marine Sciences.
For primary bibliographic entry see Field 02K.
W72-05038

BACTERIAL COUNTS OF A SECTION OF THE RED RIVER -- SUMMER, 1970,
North Dakota State Univ., Fargo. Dept. of Bacteriology.
For primary bibliographic entry see Field 05A.
W72-05056

ODORS, GASES AND PARTICULATE MATTER FROM HIGH DENSITY POULTRY MANAGEMENT SYSTEMS AS THEY RELATE TO AIR POLLUTION,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel, D. C. Ludington, A. G. Hashimoto, W. E. Burnett, and N. C. Dondero.
Final Report, New York State Dept. of Health, Division of Air Resources, Ithaca, New York, April 15, 1969. 106 p, 29 fig, 16 tab, 73 ref.

Descriptors: *Farm wastes, *Poultry, *Odor, *Gases, Ammonia, Hydrogen sulfide, Gas chromatography, Carbon dioxide, Moisture content, Organic compounds, *Air pollution.
Identifiers: *Particulate matter, Soil columns, Odor panel, Soil filtration, *Odor control.

The technological changes which have taken place in livestock production in the last few years to provide economical meat, eggs, and milk have resulted in the concentration of animals under conditions of high density for greater efficiency. This change of management practice has created problems in both waste disposal and the control of odors from these wastes. These odors are particularly obnoxious when either the animal enterprise or the land for disposal of manure is adjacent to urban or resort developments. Results of a two year research project dealing with the detection and control of air pollution from high density poultry management systems are summarized. It covers such subjects as the determination of the chemical nature of the odor of poultry manure; the quantitative determination of odors and gases from poultry manure; the role of particulate matter in air pollution; and odor control methods such as soil filtration, water scrubbing, and chemical treatment. (See also W72-05068 thru W72-05074) (Bundy-Iowa State)
W72-05067

THE QUALITATIVE DETERMINATION OF THE ODOR QUALITY OF CHICKEN MANURE,
Cornell Univ., Ithaca, N.Y. Dept. of Food Science.
W. E. Burnett.
In: Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution. Final Report, New York State Dept. of Health, Division of Air Resources, Ithaca, New York, p 2-17, April 15, 1969. 6 fig, 2 tab, 18 ref.

Descriptors: *Farm wastes, *Odor, *Poultry, Gas chromatography, Nitrogen, Ammonia, Hydrogen sulfide, Organic compounds, *Air pollution.
Identifiers: Odor panel, Organoleptic techniques, Liquid poultry manure, Odorous organic compounds.

A combination of gas chromatographic and organoleptic techniques was used to determine the chemical compounds responsible for the offensive odor of accumulated liquid poultry manure. In addition to the odorous gases, ammonia and hydrogen sulfide, a number of odorous organic compounds were identified, including the C2 to C5 organic acids, indole, skatole, diketones, mercaptans, and sulfides. Of these, organoleptic tests indicate that the organic acids, mercaptans, and sulfides were important malodorous components. Skatole was also implicated as an important malodorous component, due to its characteristic strong, fecal odor. Amines evidently play an important role in the odor as well. (See also W72-05067) (Bundy-Iowa State)
W72-05068

THE QUANTITATIVE DETERMINATION OF THE ODOR STRENGTH OF CHICKEN MANURE,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05A.
W72-05069

ANALYSES OF GASES ENCOUNTERED IN A COMMERCIAL POULTRY HOUSE,
Cornell Univ., Ithaca, N.Y. Dept. of Food Science.
For primary bibliographic entry see Field 05A.
W72-05070

GASES AND ODORS FROM UNDILUTED AND DILUTED CHICKEN MANURE,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
D. C. Ludington, A. T. Sobel, and A. G. Hashimoto.
In: Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution. Final Report, New York State Dept. of Health, Division of Air Resources, Ithaca, New York, p 47-64, April 15, 1969. 10 fig, 5 ref.

Descriptors: Farm wastes, Poultry, Odor, Carbon dioxide, Methane, Ammonia, Hydrogen sulfide, Waste dilution, *Air pollution.
Identifiers: Odor strength.

The odors and gases produced by and released from chicken manure stored and handled in the undiluted and diluted state have been observed to be considerably different. This difference was most obvious when the stored manure was being moved or agitated. More cases of air pollution attributed to egg producing poultry farms have been reported since the diluted system of storage and handling was put into practice. The release of some of the gases and odors from stored chicken manure under the undiluted and diluted state was investigated. Significant differences occurred between the odor and gas production and release by undiluted and diluted chicken manure. Carbon dioxide release from the undiluted manure was slightly greater than the release from diluted manure. The difference may not be significant. The undiluted system released significantly greater quantities of NH3 than the diluted system. Chicken manure stored in a diluted state produced significantly more H2S and NH3 than manure stored in an undiluted state. The release of H2S from the diluted system was about twice that released from the undiluted manure. Both releases were well below threshold. The odor released from the diluted manure, while the manure was quiescent, was in general, more obnoxious than that from the undiluted manure. When the manure was agitated at the end of the tests, the difference was much more pronounced. (See also W72-05067) (Bundy-Iowa State)
W72-05071

PARTICULATE MATTER,
Cornell Univ., Ithaca, N.Y. Dept. of Food Science.
For primary bibliographic entry see Field 05A.
W72-05072

SOIL FILTRATION TO REMOVE ODORS,
Cornell Univ., Ithaca, N.Y. Dept. of Food Science.
For primary bibliographic entry see Field 05D.
W72-05073

ODOR CONTROLS BY CHEMICAL TREATMENT,
Cornell Univ., Ithaca, N.Y. Dept. of Food Sciences.
For primary bibliographic entry see Field 05D.
W72-05074

SOME CHARACTERISTICS OF ARTHROBACTERS FROM A DAIRY WASTE ACTIVATED SLUDGE,
Agricultural Univ., Wageningen (Netherlands). Lab. of Microbiology.
A. D. Adamse.
Water Res. 4 (12): 797-803. 1970. Illus.
Identifiers: Activated, Arthrobacters, Dairy, Sludge, Waste.

A number of characteristics were determined of water arthrobacters isolated from a dairy waste activated sludge. These characteristics give an indication to the place of this group of bacteria among other Arthrobacter strains, isolated from different sources such as soil and cheese. The water Arthrobacter strains were different from cheese strains in many respects. They were more similar to the soil strains.--Copyright 1971, Biological Abstracts, Inc.
W72-05103

THE FORMATION OF NITRATE FROM AMMONIUM NITROGEN IN SOILS: IV. USE OF THE DELAY AND MAXIMUM RATE PHASES FOR MAKING QUANTITATIVE PREDICTIONS,
Illinois Univ., Urbana; and Iowa State Univ., Ames; and North Carolina State Univ., Raleigh.
B. R. Sabey, L. R. Frederick, and W. V. Bartholomew.
Soil Science Society of America Proceedings, Vol 33, No 1, p 276-278, January-February, 1969. 2 fig, 1 tab, 10 ref.

Descriptors: *Nitrates, *Nitrification, *Ammonia, *Soil temperature, Fertilizers, Soil amendments.
Identifiers: Ammonium oxidation.

Estimation of the amount of nitrate accumulation occurring in soil requires an understanding of the delay period and maximum rate of nitrate accumulation under defined environmental conditions. The actual maximum rates and delay periods of nitrate accumulation varied greatly between soils at several constant temperatures, whereas the relative maximum rates and delay periods were more nearly constant at any one temperature. An equation for estimating nitrate accumulation, which includes maximum rate and delay indexes, is suggested. Temperature-rate and temperature-delay indexes are presented for several soils. Values for different temperatures were predicted from actual values determined at only one temperature. The concept of delay periods and maximum rates should help evaluate the influence of other factors on nitrate accumulation. (Skogerboe-Colorado)
W72-05120

DENITRIFICATION AS A NITROGEN SINK IN LAKE MENDOTA, WISCONSIN,
Wisconsin Univ., Madison. Water Chemistry Lab.
P. L. Brezonik, and G. F. Lee.
Environmental Science and Technology, Vol 2, No 2, p 120-125, February 1968. 5 fig, 2 tab, 19 ref.

Descriptors: *Denitrification, Nitrates, Hypolimnion, Nitrogen cycle, Sediment, Sinks, Nitrites, Ammonia, Wisconsin.
Identifiers: Lake Mendota (Wisc.).

The significance of denitrification as a sink in the nitrogen budget has been determined for Lake Mendota, Wis. About 28,100 kg. of nitrogen were lost from the lake hypolimnion during the summer of 1966. However, this relatively large amount represented only about 11% of the estimated total annual nitrogen input. Denitrification rates ranged from 8 to 26 microgram of N per liter per day, while rates of nitrate reduction (to ammonia and organic nitrogen) were found by 15N tracer techniques to range from 1.4 to 13.4 microgram of N per liter per day in the hypolimnion of the lake. Nitrate depletion is more than an order of magnitude slower than oxygen depletion in the hypolimnion of Lake Mendota, and denitrification is probably not significant with respect to respiration and catabolic processes in the lake hypolimnion. There is some evidence to indicate that dissolved nitrogen gas concentrations increase above those expected on the basis of solubility as the result of denitrification. Evaluation of various nitrogen sinks for Lake Mendota has revealed that only about one third of the estimated annual nitrogen input can be accounted for by currently evaluated sinks. Sediment deposition probably accounts for most of the remaining two thirds. (Skogerboe-Colorado State)
W72-05130

A COMPARISON OF NITROGEN LOSSES FROM UREA AND AMMONIUM NITRATE IN SURFACE RUNOFF WATER,
Purdue Univ., Lafayette, Ind. Agricultural Experiment Station.
P. G. Moe, J. V. Mannering, and C. B. Johnson.
Soil Science, Vol 105, No 6, p 428-433, 1968. 3 fig, 3 tab, 9 ref.

Descriptors: *Nitrogen, *Surface runoff, *Ammonium compounds, *Urea, Loam, Fertilizers.

Small plots were established on a Zanesville silt loam having a 13% slope and a fragipan at 24-34 in. Half the plots were maintained in an established fescue sod clipped to a height of 3-4 in. and the other half were second-year fallow plowed in mid-May and disced two times in mid-July. Pellets of ammonium nitrate and urea were broadcast on the surface at rates equivalent to 400 lbs/acre of N.A. rainfall simulator was used to apply 2 1/2 in. of water at preselected times. Runoff was sampled at 5-minute intervals and analyzed for ammonium, nitrate, and urea N. Total N loss from all plots ranged between 2.4-12.7% of the applied N. Urea was present only in runoff from sod plots; most of the urea was rapidly hydrolyzed in the soil. NH4+-N was less susceptible to runoff loss in urea plots than ammonium nitrate plots probably because urea moved more deeply into the soil with water than the highly ionized ammonium nitrate. (Skogerboe-Colorado State)
W72-05142

PHOSPHORUS FERTILIZATION OF HOPS,
Agricultural Research Service, Prosser, Wash. Soil and Water Conservation Research Div.
L. C. Boawn, and P. E. Rasmussen.
Agronomy Journal, Vol 61, p 211-213, March-April, 1969. 4 tab, 3 ref.

Descriptors: *Fertilizer, *Phosphorus, *Vine crop, Agronomic crops.
Identifiers: Humulus lupulus, Alpha acid, Zinc, Extractable soil P, *Hops.

Hops were grown on field plots treated with five levels of phosphorus fertilization to determine the effect of P on vine growth, cone quality, and zinc nutrition. A maximum P treatment of 1,344 kg/ha, applied over a 5-year period, increased the extractable P level of the surface 20 cm of soil from 10 ppm to approximately 100 ppm. The P level in leaves and cones from this treatment was increased by approximately 0.10 to 0.15% P as compared with the no-P treatment. Increased levels of P had no observable effect on vine color and vigor or on total growth as determined by vine green weight. The critical level for P in sidearm leaves at early bloom was indicated to be below 0.25%. The alpha acid content of cones decreased where P fertilization exceeded approximately 500 kg/ha. However, this decrease was poorly correlated with the P content of leaves, indicating the lack of a direct causal relationship. The P treatments caused a definite reduction in the Zn concentration in leaf and cone tissues, but did not induce observable Zn deficiency symptoms. (Skogerboe-Colorado State)
W72-05148

AN ECOLOGICAL STUDY OF THE PSYCHROTROPHIC (SIC) (PSYCHROPHILIC) BACTERIA OF SOIL, WATER, GRASS AND HAY,
National Agricultural Advisory Service, Aberystwyth (Wales).
R. G. Druce, and S. B. Thomas.
J Appl Bacteriol. 33 (2): 420-435. 1970.
Identifiers: Acinetobacter-Sp, Bacteria, Ecological, Erwinia-Herbicola, Flavobacterium, Grass-M, Hay, Pseudomonas-Sp, Psychrophilic, Psychrotrophic, Soil.

A study of the psychrotrophic (sic) (psychrophilic) bacterial content, determined at 3-5 deg, of soil, grass and hay showed that these habitats were prolific sources of many different types of psychrotrophs which sometimes exceeded 10 to the 7th power/g. Untreated farm water supplies had a much lower content, few samples giving colony counts > 10 to the 4th. power/ml. Gram positive or gram variable, nonsporeforming rods, resembling coryneform bacteria, constituted a relatively high proportion of the psychrotrophic microflora of soil, gram negative rods only forming about 1/3 of the isolates. Pseudomonas and Acinetobacter spp. and yellow or orange pigmented gram negative rods were the predominant psychrotrophs in untreated water. Pseudomonas and a taxonomically heterogeneous group of yellow, pigmented, gram negative rods, a few of which resembled Flavobacterium and some Erwinia herbicola, together with Acinetobacter accounted for nearly 90% of the isolates from grass, but <50% of those from hay, which had a more complex psychrotrophic microflora than had grass.--Copyright 1971, Biological Abstracts, Inc.
W72-05158

COMPOSITION OF SURFACE WATERS OF NEW JERSEY IN RELATION TO SOIL SERIES: II. WATERS OF THE SOUTH BRANCH: RARITAN RIVER, STONY BROOK, NESHANIC RIVER AND ASSUMPINK CREEK,
Rutgers - The State Univ., New Brunswick, N.J. Coll. of Agriculture and Environmental Science.
For primary bibliographic entry see Field 05A.
W72-05198

THERMAL ADDITION STUDIES OF THE CRYSTAL RIVER STREAM ELECTRIC STATION,
Fla. Dep. Natl. Res. Mar. Res. Lab., St. Petersburg.
For primary bibliographic entry see Field 05C.
W72-05201

VIROLOGICAL SURVEYS OF THE PRESENCE OF ENTEROVIRUSES IN WASTE WATER: I. INCIDENCE OF POLIO-VIRUSES IN PRAGUE AT THE END OF 1963 AND IN 1969, (IN CZECH),
Ustav Epidemiologie a Mikrobiologie, Prague (Czechoslovakia).
J. Zdrazilek, K. Zacek, J. Chvapil, V. Mikesova, and L. Pokorna.
Cesk Epidemiol Mikrobiol Imunol. 20 (2): 67-72. 1971. English summary.

Identifiers: Czechoslovakia, End, Enteroviruses, Human, Incidence, Newborn, Polioviruses, Prague, Vaccine, Virological, Waste.

From Oct. 1968-1969 a total of 180 samples of waste water were collected using gauze tampons regularly in 10 Prague creches and branches of main Prague sewers. Poliomyelitis virus was isolated from 21 samples, non-poliomyelitis enteroviruses from 71 samples and a mixture of polioviruses with other enteroviruses was isolated from 2 samples. No enterovirus was isolated from 86 samples. With the exception of 1 type 3 strain isolated in a creche in Feb. 1968, all poliovirus strains were isolated from samples collected from April until July, the period after mass vaccination of neonates with live poliomyelitis vaccine. Polioviruses did not circulate in the population during the winter, the period at which their incidence had been the highest before introduction of the vaccination.--Copyright 1971, Biological Abstract, Inc.
W72-05226

A HYGIENIC EVALUATION OF THE NEW PLASTICIZER TOLYLNAPHTHYLMETHANE,
For primary bibliographic entry see Field 05C.
W72-05236

THE POSSIBILITY OF CONTAMINATING UNDERGROUND WATERS WITH MONONITROTOLUENE,
V. N. Kupyrov.
Gig Naselennykh Mest Resp Mezhved Sb. 9. 84-87. 1970.
Identifiers: Clay, Contaminating, Filtration, Herbicide, Mineralization, Mono, Nitrate, Nitro, Sandy, Soils, Toluene, Underground.

The possibility of mononitrotoluene (I) (used as a herbicide on water plants) penetrating through sandy and clay bottoms into underground waters was studied. When sandy bottoms are irrigated and have had I applied, the I in the filtration water penetrates an 800-mm layer of sand and is discovered in pure form as long as 15 days later. I was not found in a 5 mo. period in the filtration water passing through clay soil of the same depth. In addition, the amount of nitrate N is increased in the filtration water, showing the transitory mineralization of I in the soil. At the end of 5 mo. the amount of nitrate N was the same as in controls. The mineralization of I in the soil may end in 5 mo.--Copyright 1971, Biological Abstracts, Inc.
W72-05237

EXPERIMENTAL INVESTIGATIONS INTO THE INFLUENCE OF SOME ORGANIC--PHOSPHORIC INSECTICIDES ON THE OXYGEN CONTENT OF WATER, (IN GERMAN),
For primary bibliographic entry see Field 05C.
W72-05258

5C. Effects of Pollution

HISTOLOGICAL AND HEMATOLOGICAL RESPONSES OF AN ESTUARINE TELEOST TO CADMIUM,
National Marine Water Quality Lab., West Kingston, R.I.
George R. Gardner, and Paul P. Yevich.
Journal Fisheries Research Board of Canada, Vol 27, No 12, p 2185-2196, 1970. 1 tab, 5 fig, 45 ref.

Descriptors: Pathology, *Animal pathology, *Heavy metals, Path of pollutants, Killifishes, Toxicity, Fish diseases, Water pollution effects.
Identifiers: *Teleost pathology, *Cadmium, *Blood.

Pathological changes attributable to cadmium poisoning were observed in the intestinal tract, the kidney, and the gills of Fundulus Heteroclitus after exposure to 50 ppm of the metal. Microscopic examination revealed pathological changes of the intestinal tract as early as 1 hr after exposure, in the kidney after 12 hr, and in the gill filaments and respiratory lamellae after 20 hr. These manifestations of cadmium poisoning bear resemblance to the pathological changes that have been demonstrated clinically and experimentally in mammals. The examination of circulating blood elements revealed rapid and striking changes among cells of the eosinophil lineage. The abundance of eosinophils increased steadily to a level approximately 45% above the usual amount. Indications of the cellular increase occurred as an early rise 4 hr after exposure. A reduction in the relative numbers of mature eosinophils was evident in imprints of head kidney tissue. Nuclear anomalies were associated with the thombocytes of specimens after 8 hr exposure; however, these changes were not noticeable at either earlier or later time periods. (epa abstract)
W72-04709

LIFE HISTORIES AND DRIFTING OF THREE SPECIES OF LIMNEPHILIDAE (TRICHOPTERA),
Freshwater Biological Association, Ambleside (England).
For primary bibliographic entry see Field 05A.
W72-04714

COMPARISON OF SOME SPECIES IMPORTANCE VALUES AND ORDINATION TECHNIQUES USED TO ANALYSE BENTHIC INVERTEBRATE COMMUNITIES,
Utah State Univ., Logan. Dept. of Wildlife Resources.
For primary bibliographic entry see Field 05A.
W72-04716

PRIMARY PRODUCTION AND CHLOROPHYLL A CONTENT OF NANOPLANKTON IN A EUTROPHIC LAKE,
Lund Univ. (Sweden). Limnological Inst.
C. Gelin.
Oikos, Vol 22, p 230-234, 1971. 2 fig, 13 ref.

Descriptors: *Nanoplankton, *Phytoplankton, *Primary production, Chlorophyll, Biomass, Carbon radioisotopes, Hydrogen ion concentration, Alkalinity, Turbidity, Eutrophication, Nannoplankton.
Identifiers: *Lake Vombsjon, *Chlorophyll a, Microcystis aeruginosa, Microcystis viridis, Aphanizomenon flos-aquae, Microcystis spp., Chlamydomonas spp., Cryptomonas spp., Sweden.

During the ice cover period in 1970 the primary production and amount of chlorophyll a in nannoplankton (less than 20 millimicrons) were compared to the production and amount of chlorophyll a in the total phytoplankton community in the eutrophic lake Vombsjon in Scania, South Sweden. Primary production was determined by the carbon 14 technique and the chlorophyll a content was determined mathematically. Immediately after the break up of the ice, nannoplankton was responsible for at least 90 percent of total primary production. Chlorophyll a content of the nannoplankton was 15.0 mg/cu meter in the beginning of May. During the period July through October its share of the total primary production was about 20 percent, and its chlorophyll a content varied between 12.7 and 20.8 mg/cu meter. (Holoman-Battelle)
W72-04717

VERTICAL DISTRIBUTION OF SOME CILIATED PROTOZOA IN TWO FRESHWATER SEDIMENTS,
Freshwater Biological Association, Ambleside (Sweden).
R. Goulder.
Oikos, Vol 22, No 2, p 199-203, 1971. 1 fig, 3 tab, 31 ref.

Descriptors: *Protozoa, *Sediments, *Distribution patterns, Cores, Sampling, Density, Oxygen requirements, Microscopy, Benthos.
Identifiers: England, Loxodes magnus, Loxodes striatus, Stentor coeruleus, Spirostomum teres, Frontonia lencas, Stentor polymorphus, Parameciu candatum, Spirostomum ambiguum, Feeding.

The vertical distribution of the larger (greater than 200 millimicrons) benthic ciliated protozoa was investigated in Esthwaite Water and Priest Pot in the English Lake District in May and June 1970. A sampling device was used which enabled cores of sediment to be divided into 1-cm thick strata. Ciliates were counted in each 1-cm stratum from 0 to 6 cm. The most frequent species, were Loxodes magnus and Stentor coeruleus in Esthwaite Water and L. magnus and L. striatus in Priest Pot. In both waters almost all ciliates were found in the 0-1 cm stratum. Sediment texture, oxygen regime, and feeding conditions are discussed as factors which might control the distribution. Numbers of ciliates per unit area of sediment were greater in Priest Pot and this may be related to the more eutrophic conditions. (Mortland-Battelle)
W72-04718

STUDY ON THE NEW STRAIN OF THE PATHOGENIC 'VIBRIO' ISOLATED FROM FRESHWATER FISHES,
For primary bibliographic entry see Field 05A.
W72-04720

METALS FOCUS SHIFTS TO CADMIUM.
For primary bibliographic entry see Field 05B.
W72-04727

LEVELS OF INORGANIC AND TOTAL PHOSPHORUS IN LAKE SEDIMENTS AS RELATED TO OTHER SEDIMENT PARAMETERS,
Wisconsin Univ., Madison. Dept. of Soil Science.
J. D. H. Williams, J. K. Syers, S. S. Shukla, R. F. Harris, and D. E. Armstrong.
Environmental Science and Technology, Vol 5, No 11, p 1113-1120, November 1971. 3 fig, 5 tab, 37 ref.

Descriptors: *Eutrophication, *Phosphorus, *Sediments, *Statistical methods, Lakes, Wisconsin, Carbon, Iron, Aluminum, Manganese, Sampling, Colorimetry, Volumetric analysis, Spectrophotometry.
Identifiers: *Sample preservation, Devils Lake, Lake Little John, Trout Lake, Crystal Lake, Content Lake, Plum Lake, Little Arbor Vitae Lake, Lake Minocqua, Tomahawk Lake, Lake Wingra, Lake Mendota, Lake Monona, Lake Delavan, Lake Geneva, Ekman dredge, Factor analysis.

Relationships were determined for the levels of inorganic and total phosphorus in lake sediments to the amounts, forms, and reactivities of iron, aluminum, and manganese components and CaCO3. An Ekman dredge was used to collect sediment samples from 14 hard-water and soft-water Wisconsin Lakes, which represented a wide range of trophic states. These samples were stored in the dark, at 4C, in airtight bottles before determination of the above components by various analytical means. The levels of inorganic P in 16 noncalcareous and 9 calcareous surficial sediments were closely related to the amounts of short-range order hydrated iron oxides extractable by acid ammonium oxalate or neutral citrate-dithionite-bicarbonate (CDB). The Fe/P atomic ratios of the short-range order Fe-inorganic P complex, resulting from the sorption of orthophosphate by hydrated Fe oxides, varied between 5 and 10 for most sediments, although ratios exceeding 20 were obtained for six noncalcareous sediments. Variations in the amount of the complex accounted for most of the difference in total Fe and total P between sediments. Oxalate- and CDB-extractable forms of Al were associated with organic P but not inorganic P; organic P was also associated with organic C. Weak statistical relationships between Mn and inorganic P were accounted for by Mn-Fe interrela-

tionships. Calcium carbonate was not directly related to any P parameter. (Mortland-Battelle)
W72-04732

STRATEGIES FOR CONTROL OF MAN-MADE EUTROPHICATION,
Committee on Public Works (U.S. Senate).
For primary bibliographic entry see Field 05D.
W72-04734

DISTRIBUTION OF BLUE-GREEN ALGAL VIRUSES IN VARIOUS TYPES OF NATURAL WATERS,
Delaware Univ., Newark. Dept. of Biological Sciences.
For primary bibliographic entry see Field 05B.
W72-04736

EFFECTS OF SODIUM CHLORIDE ON OUTGROWTH AND TOXIN PRODUCTION OF CLOSTRIDIUM BOTULINUM TYPE E IN COD HOMOGENATES,
Fisheries Research Board of Canada, Vancouver (British Columbia). Vancouver Lab.
J. W. Boyd, and B. A. Southcott.
Journal of the Fisheries Research Board of Canada, Vol 28, No 8, p 1071-1075, August 1971. 2 tab, 18 ref.

Descriptors: *Sodium chloride, *Clostridium, *Growth stages, Bacteria, Fish, Inhibitors, Toxicity, Toxins, Assay, Cultures, Sampling.
Identifiers: *Pacific cod, Biological samples, *Toxin production, *Cod, Clostridium botulinum type E Minnesota, Clostridium botulinum type E Saratoga, Clostridium botulinum type E Tennessee, Gadus macrocephalus, Survival.

The sodium chloride tolerance of Clostridium botulinum type E strains Minnesota, Saratoga, and Tennessee was determined in heat-processed cod homogenates prepared from fresh frozen Pacific cod (Gadus macrocephalus). Homogenates were inoculated with heat-activated spores and incubated anaerobically at 30 C. The Minnesota strain produced a maximum toxin titer of 800 MLD (minimal lethal dose)/g in homogenates without added NaCl (control samples); a brine concentration of 3.76 percent (NaCl content in aqueous phase) inhibited toxin formation in homogenates, but did not inhibit outgrowth and vegetative cell multiplication. A maximum titer of 75 MLD was formed by the Saratoga strain in control samples; growth occurred in homogenates with a 3.84 percent brine content without the formation of toxin. The Tennessee strain produced a maximum titer of 1000 MLD in control samples; toxin of low potency was formed in homogenates containing 4.40 percent brine. A brine concentration of 5.50 percent in homogenates was sporistatic to the Saratoga and Tennessee strains, but not to the Minnesota strain. Toxin was produced in subcultures prepared from homogenates in which growth was inhibited by NaCl. (Holoman-Battelle)
W72-04737

DETECTION OF CLOSTRIDIUM BOTULINUM TYPE E IN SMOKED FISH,
Food and Drug Administration, Washington, D.C. Div. of Microbiology.
For primary bibliographic entry see Field 05A.
W72-04745

TOXICITY OF SEAWATER TO COLIFORM BACTERIA,
Washington Univ., Seattle. Dept. of Civil Engineering.
Hugh P. Savage, and N. BruceHanes.
J Water Pollut Contr Fed. 43 (5): 854-861. 1971. Illus. French, German, Portugese and Spanish summary.
Identifiers: Bacteria, Coliform, Fecal, Indicator, Pollution, Sea, Toxicity.

Samples of seawater were seeded with raw domestic wastewater and artificial wastewater nutrients to study the relationship of total and fecal coliforms to initial nutrient levels. Below 10 mg/l initial biochemical oxygen demand (BOD), the total and fecal coliforms entered a death phase without demonstrating a growth phase. Above 10 mg/l, both bacterial groups demonstrated a growth phase and reached a maximum density that varied directly with the initial BOD levels. The percentage of both fecal and total coliform bacteria in the total population increased as the maximum density was approached and decreased as the total population declined. By themselves, total and fecal coliforms are not reliable indicators of fecal pollution because given sufficient nutrient levels, the bacterial density will increase.--Copyright 1971, Biological Abstracts, Inc.
W72-04757

EUTROPHICATION OF SMALL RESERVOIRS IN THE GREAT PLAINS,
Nebraska Univ., Lincoln. Dept. of Civil Engineering; and Nebraska Univ., Lincoln. Dept. of Zoology.
Mark J. Hammer, and Gary L. Hergenrader.
Nebraska Engineer, June 1971. 5 p, 3 fig, 1 tab. OWRR A-014-NEB (4).

Descriptors: *Eutrophication, *Reservoirs, *Great Plains, Nutrients, Recreation, Light penetration, Nebraska, Wastewater treatment, Turbidity, Runoff, Phosphorus, Algae, Aquatic plants, Clays, Odor, Water quality, Food chains, Dissolved oxygen, Copper sulfate, Herbicides, Water pollution effects, Water pollution sources, Water pollution control.
Identifiers: Salt Valley Reservoirs (Neb), Madison (Wis), Lake Washington (Wash), Dyeing water.

Reservoirs built within a 20-mile radius of Lincoln, Nebraska, for flood control and soil conservation with recreation as a secondary benefit have deteriorated due to eutrophication. The runoff waters entering are principally from cultivated farmland and contain sufficient nutrient salts to support abundant growths of aquatic plants. There is no ready solution for removal of nutrients from land runoff. It is doubtful that soil and water conservation practices can reduce the nutrient levels in runoff sufficiently to prevent eutrophication. The rainfall-runoff patterns of typical Nebraska weather make nutrient control in drainage water impractical. Use of copper sulfate for algal blooms has been abandoned due to its toxicity in bottom muds to aquatic life; herbicides must be used with caution to prevent unwanted biological damage. Plant growth harvesting in most situations can remove only small quantities of nutrients. A new and novel approach to controlling weed and algae growth is being evaluated--inhibiting sunlight penetration through application of chemical dyes into the water or onto the surface. Commercially available dyes are being tested with cultures of blue-green algae, commonly blooming in the Salt Valley Reservoirs. (Jones-Wisconsin)
W72-04759

EUTROPHICATION OF SMALL RESERVOIRS IN THE GREAT PLAINS,
Nebraska Univ., Lincoln.
Gary L. Hergenrader, and Mark J. Hammer.
Available from the National Technical Information Service as PB-206 953, $3.00 in paper copy, $0.95 in microfiche. Mimeo (Undated). 26 p, 4 fig, 4 tab, 6 ref. owrr a-014-NEB (5).

Descriptors: *Eutrophication, *Reservoirs, *Great plains, Algae, Nebraska, Turbidity, Stratification, Temperature, Chlorophyll, Cyanophyta, Aquatic plants, Phosphorus, Density, Water pollution sources, Runoff, Light penetration, Sampling, Primary productivity, Phytoplankton, Euglena, Chlorophyta, Nitrates, Ammonia, Carbon, Recreation, Water pollution control, Alkalinity, Dissolved solids.
Identifiers: *Salt Valley Reservoirs (Neb), *Clear water reservoirs, *Turbid reservoirs, Cyclotella, Trachelomonas, Melosira, Stephanodiscus, Anabaena, Aphanizomenon, Microcystis, Potamogeton, Polygonum, Sagittaria, Najas.

Limnological studies of five reservoirs in the Salt Valley Watershed District (eastern Nebraska) were initiated to determine existing trophic conditions, estimate eutrophication rates, if possible, by measuring changes in several parameters, identify sources of nutrient inputs, and evaluate preventative and remedial measures. During June, July, and August, each of the study reservoirs was sampled at weekly intervals; one lake was sampled throughout the year, but less frequently during ice-cover. Water samples were analyzed for dissolved oxygen, temperature, underwater light intensity, alkalinity, pH, hardness, dissolved and suspended solids, iron, COD, phosphates, ammonia, nitrate and organic nitrogen, chloride, sulfate, and turbidity; algae identified, and primary production determined. Runoff waters impounded in the reservoirs contain sufficient nutrient salts to support abundant growths of aquatic plants. Reservoirs, light-limited by soil turbidity, support neither abundant growths of aquatic plants nor dense blue-green algal blooms; clear water reservoirs are very eutrophic. Eutrophication rate is very rapid and apparently directly related to age. Control of photosynthesis through inhibition of sunlight penetration by the addition of various substances into the reservoirs directly or to the water surface should be investigated. (Jones-Wisconsin)
W72-04761

AGRICULTURAL POLLUTION OF THE GREAT LAKES BASIN.
For primary bibliographic entry see Field 05B.
W72-04762

POPULATION DYNAMICS OF SELECTED ZOOPLANKTON IN THREE OLIGOTROPHIC OREGON LAKES,
Oregon State Univ., Corvallis. Dept. of Fisheries and Wildlife.
James G. Malick.
MS Thesis, June 1971. 112 p, 33 fig, 18 tab, 20 ref, append. OWRR A-003-ORE (5).

Descriptors: *Aquatic populations, *Bioindicators, *Zooplankton, *Oligotrophy, *Lakes, Oregon, Sampling, Daphnia, Primary productivity, Density, Temperature, Limnology, Statistical methods, Lake morphometry.
Identifiers: Crater Lake (Ore), Odell Lake (Ore), Woahink Lake (Ore), Daphnia pulex, Bosmina longispina, Daphnia longispina, Cyclops bicuspidatus thomasi, Diaphanosoma brachyurum, Diaptomus franciscanus, Epischura nevadensis, Population dynamics, Instantaneous birth rates.

Daphnia pulex, Daphnia longispina, and Diaphanosoma brachyurum were studied in their respective oligotrophic Oregon lakes to determine whether instantaneous zooplankton birth rates and densities can be used in lake classification. Relationship between diel vertical distribution and temperature and phytoplankton primary production were investigated. Changes in zooplankton density from one year to the next and lack of correlation between phytoplankton primary production and density nullified application of these population dynamics to lake systematics. The finite birth rate also lacked the expected correlation with phytoplankton primary production (perhaps due to interactions between total zooplankton species present). If instantaneous birth rate and density were calculated for all species in each lake they might be used for lake classification, but analytical time expended would be prohibitive. The diel vertical distribution of Daphnia showed migration to surface at night and return to deeper water during daylight hours. In Woahink Lake, Daphnia and Diaphanosoma migrated only when temperatures

near 15C or greater were reached. Phytoplankton primary production occurring during periods of no migration was equal to or greater than that occurring during periods of vertical migration. (Jones-Wisconsin)
W72-04763

EFFECTS OF INCREASED TEMPERATURE ON COLD-WATER ORGANISMS,
National Marine Fisheries Service, Seattle, Wash.
George R. Snyder, and Theodore H. Blahm.
J Water Pollut Contr Fed. 43 (5): 890-988. 1971. Illus, Map. Fr., Ger., Port. and Span. summ.
Identifiers: Biota, Cold, Destruction, Fish, Organisms, Pollution, Salmon, Temperature, Thermal, Trout.

Thermal pollution is one of the problems that man must resolve if he wishes to maintain the quality of his environment. It is predicted that thermonuclear electric power will increase 16-fold in the Pacific Northwest and equal that of hydroelectric power by 1985. Without adequate controls, adverse conditions could be produced by discharge of waste heat into the aquatic environment. Uncontrolled releases of heat can destroy, dislodge, or debilitate portions of the aquatic biota. Controlled releases of heat, however, may even benefit some organisms. Increased water temperatures will not only delay migrations of anadromous fish but also induce direct or indirect stresses and contribute to serious disease problems, and it will favor some species of fish that compete with (and prey on) important stocks of salmon and trout. It is more likely to benefit saltwater habitats, especially manmade canals, ponds, and raceways, than freshwater habitats.--Copyright 1971, Biological Abstracts, Inc.
W72-04764

AN ARTIFICIAL ALTERATION OF THE SEASONAL CYCLE OF THE PLANKTON DIATOM MELOSIRA ITALICA SUBSP SUBARCTICA IN AN ENGLISH LAKE,
Freshwater Biological Association, Ambleside (England).
J. W. G. Lund.
The Journal of Ecology, Vol 59, No 2, p 521-533, 1971. 4 fig, 13 ref.

Descriptors: *Cycles, *Plankton, *Diatoms, *Lakes, Seasonal, Stratification, Silica, Nutrients, Mixing, Period of growth.
Identifiers: *Melosira italica, Asterionella formosa, English Lake District (England).

For 24 years the seasonal cycle of the planktonic diatom Melosira italica subsp subarctica has been studied and correlated with changes of the thermal, and so density, stratification of water in Blelham Tarn, England. In 1967, the vernal population was the largest ever recorded; the early summer and early autumn increases were small and the late summer increase large, the latter caused by artificial destratification and favorable nutrient conditiosns. The population size was greater than in spring for most years since 1945. In 1967, the population began to die by the end of August. Though the available data point to nutrient depletion as the cause of mortality, there seemed no lack of available silicon, nitrogen, or phosphorus. Reasons are given for the view that, if the lake was isothermal and vertically mixed each summer, large populations of Melosira would not always develop. Perhaps the normal, seasonal alternation of stratified and unstratified water may be of biological advantage to Melosira, enabling it to compete with diatoms which can produce large populations but cannot live long on or in deposits in the dark or in absence of oxygen. (Jones-Wisconsin)
W72-04765

THE DISTRIBUTION AND NET PRODUCTIVITY OF SUBLITTORAL POPULATIONS OF ATTACHED MACROPHYTIC ALGAE IN AN ESTUARY ON THE ATLANTIC COAST OF SPAIN,
Durham Univ. (England). Dept. of Botany.
D. M. John.
Marine Biology, Vol 11, No 1, p 90-97, 1971. 3 fig, 3 tab, 39 ref.

Descriptors: *Aquatic plants, *Distribution, *Marine algae, *Estuaries, Productivity, Population, Atlantic Ocean, Depth, Standing crop, Currents (Water), Waves (Water), Sampling, Benthos, Grazing, Gastropods, Littoral, Age, Biomass, Light quality, Light penetration, Efficiences, Competition, Growth rates, Plant morphology, Water circulation.
Identifiers: *Sublittoral benthic macrophytes, Ria de Aldan (Spain), Laminaria ochroleuca, Saccorhiza polyschides.

Distribution of sublittoral populations of Laminaria ochroleuca and Saccorhiza polyschides was studied at seven localities on the northwest coast of Spain. Possible factors controlling the equilibrium between the two populations were assessed and the net productivity of these populations measured by in situ cropping using SCUBA diving techniques. A narrow transition zone between the two populations was found and the depth of this zone was governed by amount of water movement. Total standing crop and productivity per unit area decreased with both an increase in depth and wave action while the highest values of all were in two localities where there was considerable current surge. The maximum productivity of L ochroleuca was found in the most sheltered locality, while the highest value for S polyschides was found where current surge was greatest but wave action only moderate. The net percentage efficiency of energy fixation shows a nearly linear relationship with depth when based on surface radiation. When efficiency is based on the radiation reaching each depth, there is a fall-off above and below 8.4 meters; an inverse relationship exists between productivity and efficiency down to this depth but not below. (Jones-Wisconsin)
W72-04766

ABCS OF CULTURAL EUTROPHICATION AND ITS CONTROL. PART I--CULTURAL CHANGES,
Metcalf and Eddy, Inc., Boston, Mass.
Clair N. Sawyer.
Water and Sewage Works, p 278-281, September 1971. 5 fig, 2 tab, 2 ref.

Descriptors: *Eutrophication, *Carbon, *Water pollution control, Water pollution effects, Nutrients, Algae, Cyanophyta, Phosphorus, Water pollution sources, Hydrogen ion concentration, Carbon dioxide, Nitrogen, Chlorophyta, Nitrogen fixation, Land management, Fertilization, Primary productivity.

Drastic changes in nutrient input must be accomplished in order to control cultural eutrophication. Although indications are that green algae and many blue-green algae are dependent upon fixed forms of nitrogen, at least four genera of blue-greens (Anabaena, Gloeotrichia, Aphanizomenon and Nostic) are capable of fixing atmospheric nitrogen. Success of nitrogen control in some areas could depend to a great extent on the cooperation of farmers in curtailing bad land management and fertilization practices. Phosphorus gains access to natural waters mainly through the discharge of wastewaters and to some extent through surface wash from farmlands. Wastewater treatment methods for phosphorus removal from effluents have been known for several years, and a large part of phosphorus in domestic wastewaters and essentially all phosphorus in some industrial wastes, is contributed by synthetic detergents. Phosphorus limitation in lakes and streams seems to be the only known means to control nitrogen-fixing blue-green algae. Thus phosphorus removal must be part of any plan to control eutrophication in addition to nitrogen removal, which is the second most important nutrient in primary production. (Jones-Wisconsin)
W72-04769

DIURNAL RHYTHMS IN NETPLANKTON AND NANNOPLANKTON ASSIMILATION RATIOS,
Stanford Univ., Pacific Grove, Calif. Hopkins Marine Station.
T. C. Malone.
Marine Biology, Vol 10, No 4, p 285-289, 1971. 2 fig, 2 tab, 23 ref.

Descriptors: *Biorthyms, *Plankton, *Diurnal, *Marine plants, *Photosynthesis, Nannoplankton, Chlorophyll, Pacific Ocean, Oligotrophy, Tropical regions, Nitrogen, Surface waters, Eutrophication, Nitrates, Light intensity, Primary productivity, Nutrients, Carbon radioisotopes, Fluorometry, Sampling, Temperature, Temperate, Neritic, Oceans.
Identifiers: *Netplankton, Assimilation ratios, California Current.

To determine the character of diurnal variations in netplankton and nannoplankton assimilation ratios under different nutrient regimes, surface netplankton and nannoplankton photosynthetic capacities and chlorophyll a concentrations were measured 3 hours before and 3 hours after local apparent noon at 36 stations in three general types of oceanic environments: temperate California Current waters, oligotrophic surface waters of the eastern tropical Pacific, and eutrophic tropical surface waters. No significant morning or afternoon periodicity was observed for either netplankton or nannoplankton assimilation ratios in temperate waters. In tropical waters, however, netplankton assimilation ratios were highest in the afternoon on both eutrophic and oligotrophic waters, while the nannoplankton exhibited maximum assimilation ratios in the morning in oligotrphic waters and in the afternoon in eutrophic waters. These results suggest that diurnal variations in assimilation ratios will exhibit a morning or afternoon maximum depending upon the relative importance of nannoplankton and netplankton as primary producers and the availability of essential nutrients. These assimilation ratios reflected the nitrate concentrations of the three regions studied, which was very low in oligotrophic tropical surface waters, high in eutrophic tropical surface waters, and moderate in temperate California Current waters. (Jones-Wsiconsin)
W72-04770

SOME OBSERVATIONS ON THE LIMNOLOGY OF A POND RECEIVING ANIMAL WASTES,
Oklahoma State Univ., Stillwater. Dept. of Zoology.
Dale W. Toetz.
Proceedings Oklahoma Academy of Science, Vol 51, p 30-35, 1971. 4 fig, 2 tab, 11 ref.

Descriptors: *Oxidation lagoons, *Water pollution effects, *Farm wastes, Oklahoma, Cyanophyta, Chlorella, Ions, Phytoplankton, Nitrates, Nitrogen fixation, Algae, Conductivity, Chlorophyll, Pigments, Dispersion, Runoff.
Identifiers: *Feedlots, Lemna.

A small pond receiving runoff from a hog yard was dominated by a large population of blue-green algae and phytoflagellates during summer and by Chlorella sp during winter. Heavy rainfalls decreased the ionic concentration of water and altered the phytoplankton composition. Occasional concentration of oxygen below 5 mg/l and high ammonia content suggested that the pond is unsuitable for warm-water fish culture. (Wilde-Wisconsin)
W72-04773

PHOSPHATE EQUILIBRIA ON STREAM SEDIMENT AND SOIL IN A WATERSHED DRAINING AN AGRICULTURAL REGION,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
Alan W. Taylor, and Harry M. Kunishi.

Agricultural and Food Chemistry, Vol 19, No 5, p 827-831, 1971. 10 fig, 6 ref.

Descriptors: *Phosphates, *Adsorption, *Sediments, Soils, Runoff, Agriculture, Streams, Mode of action.
Identifiers: *Phosphate equilibria, Mahantango Watershed (Pa), Little Deep Creek (Pa).

Concentration of available phosphorus was determined in stream water, streambed sediment, and soils surrounding the stream in an agricultural region watershed. A comparison of the equilibrium level of soluble phosphates in the water layer adjacent to sediment with the level of phosphates in stream water indicated the movement of phosphates toward the sediment. The latter serves as an accumulator of soluble phosphates decreasing their downstream concentration. Base material of subsoils and stream banks also act as strong buffers reducing the phosphate level of the stream. (Wilde-Wisconsin)
W72-04774

NUTRIENT REMOVAL BY WATER-HYACINTH,
Auburn Univ., Ala.
Hugo H. Rogers, Jr.
MS Thesis, August 1971. 93 p, 11 fig, 10 tab, 93 ref, append.

Descriptors: *Aquatic weeds, *Eutrophication, *Water hyacinth, *Nutrients, Phosphorus, Nitrogen, Lentic environments, Lotic environments, Water purification, Water pollution sources, Water pollution effects, Water pollution control, Sewage effluents, Evapotranspiration, Dissolved solids.
Identifiers: *Eichhornia crassipes, Lake Seminole (Ga).

In static water, Eichhornia crassipes removed significant amounts of phosphorus from 0.1 and 0.25 Hoagland's solution in 48 hours and from sewage effluent in 24 hours. The 0.5 Hoagland's solution was not influenced by the plants. In flowing water the effect of plants was significant in the solution at all three concentrations. In static water nitrogen concentration was significantly reduced within 24 hours in 0.1 and 0.25 Hoagland's solution and in sewage effluent, but remained unchanged in the 0.5 solution. The flow of the solution failed to alter the effect of plants on nitrogen concentration. The daily water loss per plant was about 175 ml in static water and 245 ml in flowing water. One hectare of water hyacinth could absorb in six months the annual nitrogen and phosphorus wastes of about 550 people. (Wilde-Wisconsin)
W72-04776

INLAND LAKE DREDGING EVALUATION.
Strand (John A.) and Associates, Inc., Madison, Wis.
For primary bibliographic entry see Field 08C.
W72-04778

SPACE-TIME SAMPLING OF ECOLOGICAL SYSTEMS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 06A.
W72-04779

KINETICS OF ALGAL SYSTEMS IN WASTE TREATMENT--AMMONIA-NITROGEN AS A GROWTHLIMITING FACTOR AND OTHER PERTINENT TOPICS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 05D.
W72-04787

KINETICS OF ALGAL SYSTEMS IN WASTE TREATMENT--PHOSPHORUS AS A GROWTH LIMITING FACTOR,
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 05D.
W72-04788

WATER QUALITY OFFICE.
Environmental Protection Agency, San Francisco, Calif. Water Quality Office.

Environmental Protection Agency, Pacific Southwest Region Water Quality Office Report, December 1970. 59 p, 3 fig, 10 tab, 11 ref, 3 append.

Descriptors: *Water quality, *Water pollution effects, *Lakes, *Colorado, *Recreation facilities, Water temperature, Chemical analysis, Algae, Nutrients, Water analysis, Domestic wastes.
Identifiers: Grand Lake (Colo), Shadow Mountain Lake (Colo), Lake Granby (Colo).

Laboratory analyses of samples collected from Grand Lake, Shadow Mountain Lake, and Lake Granby (one of the most popular recreational areas in Colorado) show that the inorganic concentrations were uniform throughout the lakes and average 0.107 mg/l. This concentration is approximately one-third of that considered necessary to initiate an algae bloom. The orthophosphate concentration in the three lakes averaged 0.0255 mg/l. This average concentration exceeds the minimum level of orthophosphate considered as necessary to sustain an algae 'bloom' (0.010 mg/l). Lake Granby and Grand Lake had thermally stratified layers although thermoclines were not in evidence. Shadow Mountain Lake was generally isothermal because of its shallow depth. The dissolved oxygen concentration in the near surface waters of all three lakes exceeded the 6.0 mg/l standard for cold water fisheries at all stations except for one Station on Shadow Mountain Lake. The water quality of the three lakes was equal to or better than the standards established for the three lakes except that the dissolved oxygen concentrations in the hypolimnion of Lake Granby were less than the established standards of 6.0 mg/l. (Woodard-USGS)
W72-04791

NATURAL CONDITIONS AND AQUATIC LIFE OF THE BRATSK RESERVOIR (FORMIROVANIYE PRIRODNYKH USLOVIY I ZHIZNI BRATSKOGO VODOKHRANILISHCHA).
For primary bibliographic entry see Field 02H.
W72-04853

FORMATION OF PHYTOPLANKTON IN THE BRATSK RESERVOIR (FORMIROVANIYE FITOPLANKTONA BRATSKOGO VODOKHRANILISHCHA),
Limnologicheskii Institut, Irkutsk (USSR).
O. M. Kozhova.
In: Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha; Izdatel 'stvo 'Nauka', Moscow, p 26-160, 1970. 24 fig, 37 tab, 68 ref.

Descriptors: *Aquatic plants, *Aquatic algae, *Phytoplankton, *Reservoirs, *Reservoir stages, Early impoundment, Biomass, Diatoms, Chlorophyta, Cyanophyta, Pyrrophyta, Chrysophyta, Euglenophyta, Water temperature, Thermal stratification, Ice, Eutrophication, Oxygen, Seasonal.
Identifiers: *USSR, *Irkutsk Oblast, *Bratsk Reservoir, *Hydrobiology, Metalimnion, Bacillariophyta, Volvocineae, Protococcineae, Ulotrichineae, Desmidiales.

Seasonal changes in the composition, production, and vertical and horizontal distribution of phytoplankton in the Bratsk Reservoir, Eastern Siberia, (area--5,500 sq km; volume--179 cu km) during its early impoundment (1963-65) are examined. The phytoplankton is represented by 118 algal species, consisting of 47 Chlorophyta, 20 Cyanophyta, 17 Bacillariophyta, 14 Pyrrophyta, 11 Chrysophtya, and 9 Euglenophyta. A total of 17 dominant species were identified in 1964 and 13 in 1965. The most massive algal populations are Aphanizomenon flos-aquae, Stephanodiscus hantzschii, Melosira islandica helvetica, and Asterionella formosa. No water blooms are found under ice (although the biomass is several mg/cu m). Bacillariophyta are predominant in spring (several g/cu m); an annual biomass maximum of 320 g of dominant Aphanizomenon flos-aquae/cu m is observed in summer and fall. Maximum biomasses increased from 12 to 320 g/cu m between 1963 and 1965; average areal indices for the reservoir during the summer maximum were 55 g/sq m in 1964 and 195 g/sq m in 1965. Maximum biomass index was 816 g/sq m and approached eutrophic conditions. Total phytoplankton production of oxygen also changed. In 1964 it was 100 g/sq m or 370 kcal/sq m during the growing period and in 1965-66 it was 389 g/sq m. River inflow contains about 13,000 metric tons of phytoplankton. A total of 30,000 metric tons is discharged from the reservoir. Phytoplankton composition, production, vertical distribution, and biomass are determined by the morphometric heterogeneity of the reservoir, its enormous size, and by differences in reservoir depths, which range from 3 to 100 m. (See also W72-04853) (Josefson-USGS)
W72-04855

AQUATIC BACTERIA IN THE BRATSK RESERVOIR IN 1965 (BAKTERIOPLANKTON BRATSKOGO VODOKHRANILISHCHA V 1965 G.),
Limnologicheskii Institut, Irkutsk (USSR).
For primary bibliographic entry see Field 02H.
W72-04856

FORMATION OF ZOOPLANKTON IN THE BRATSK RESERVOIR DURING THE FIRST TWO YEARS OF IMPOUNDMENT, 1962-63 (FORMIROVANIYE ZOOPLANKTONA V PERVYYE DVA GODA ZAPOLNENIYA BRATSKOGO VODOKHRANILISHCHA (1962-1963 GG.)),
For primary bibliographic entry see Field 02H.
W72-04857

LONG-TERM WATER-QUALITY CHARACTERISTICS OF THE BRATSK RESERVOIR AND FORECAST OF ORGANIC MATTER ACCUMULATION (MNOGOLETNYAYA KHARAKTERISTIKA FORMIROVANIYA KACHESTVA VODY I PROGNOZ NAKOPLENIYA ORGANICHESKOGO VESHCHESTVA V BRATSKOM VODOKHRANILISHCHE),
Vsesoyuznyi Nauchno-Issledovatelskii Institut Vodosnabzheniya, Kanalizatskii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
N. M. Bochkov, and B. S. Kachurin.
In: Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha; Izdatel 'stvo 'Nauka', Moscow, p 213-225, 1970. 3 fig, 5 tab.

Descriptors: *Reservoirs, *Reservoir stages, *Water quality, *Water chemistry, *Organic matter, Oxidation, Chemical analysis, Water analysis, Color, Water temperature, Discharge (Water), Inflow, Seasonal, Forecasting.
Identifiers: *USSR, *Irkutsk Oblast, *Bratsk Reservoir, Angara River, Oka River, Lake Baykal.

The Bratsk Reservoir in Eastern Siberia (Irkutsk Oblast) is fed in winter by Lake Baykal waters discharged through the Irkutsk Reservoir. In summer the ratio of the volume of Lake Baykal water to lateral inflow is almost the same. Impoundment of the reservoir in 1961-66 resulted in an increase in the color of the water (from an average of 5 to an average of 12 units), an increase in bichromate oxidation (from an average of 10 to an average of 15 mg/liter), and an accumulation of dissolved organic matter. Approximate calculation of the organic matter balance of the reservoir was based on estimation of reservoir uptake of organic matter at the Bagadansk gaging station in the An-

gara section and at the Novo-Dolonovo station in the Oka section. Annual flow of organic matter into the reservoir was negligible and ranged from 1,004,000 to 1,177,000 metric tons. Organic matter discharged from the reservoir (expressed in bichromate oxidation) varied between 583,000 and 739,000 metric tons a year. Organic residue formed annually in the reservoir during its impoundment was 336,000-491,000 metric tons. Forecast of organic matter accumulation in the reservoir only gives a picture of annual organic matter content. Monthly inflow and outflow amounts of organic matter are far more difficult to forecast. (See also W72-04853) (Josefson-USGS)
W72-04859

WATER QUALITY OF THE BRATSK RESERVOIR DURING THE FIRST YEARS OF IMPOUNDMENT, 1962-64 (SANITARNOYE SOSTOYANIYE BRATSKOGO VODOKHRANILISHCHA V PERVYYE GODY YEGO ZAPOLNENIYA (1962-1964 GG.)),
Nauchno-Issledovatelskii Institut Gigieny, Moscow (USSR).
I. A. Kibal'chich, and T. Z. Artemova.
In: Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha; Izdatel 'stvo 'Nauka', Moscow, p 226-275, 1970. 16 fig, 12 tab, 22 ref.

Descriptors: *Aquatic microbiology, *Biochemistry, *Aquatic bacteria, *Water quality, *Reservoir stages, Early impoundment, Water pollution sources, Waste water (Pollution), Wastes, E. coli, Aerobic bacteria, Anaerobic bacteria, Bacteriophage, Oxidation, Organic matter, Proteins, Amino acids, Color, Thermal stratification, Seasonal.
Identifiers: *USSR, *Irkutsk Oblast, *Bratsk Reservoir, *Bacteriology, Saprophytes, Metalimnion.

Water-quality characteristics of the Bratsk Reservoir, Eastern Siberia, during the first years of impoundment (1962-64) are examined from the standpoint of the bacteria content in the lake and water-supply safety. Water quality of the reservoir is determined by such natural factors as composition of inflowing water and effects of regulated flow, and by movement of contaminants during floods. The first years of impoundment were marked by intensive microbiological processes, which were most pronounced in summer. Deep waters of the reservoir are characterized by a summer and winter temperature stratification which affects water quality, the highest being recorded in layers at mid-depths. In summer reservoir waters contain large numbers of lactose-negative varieties of bacteria, which have retained the capacity to decompose glucose at 43 deg C. Chemical and bacteriological examination of the water includes study of the behavior of Escherichia coli and of the antagonistic activity of saprophytes in relation to it. Except for areas with inundated forest expanses, the Bratsk Reservoir and its individual reaches may be regarded hygienically safe as a water-supply source. (See also W72-04853) (Josefson-USGS)
W72-04860

ANNUAL PHYTOPLANKTON CYCLE OF THE CAPE FEAR RIVER ESTUARY, NORTH CAROLINA,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02L.
W72-04902

A TEN-YEAR STUDY OF MEROPLANKTON IN NORTH CAROLINA ESTUARIES: ANNUAL OCCURRENCE OF SOME BRACHYURAN DEVELOPMENTAL STAGES,
North Carolina Univ., Morehead City. Inst. of Marine Science.
For primary bibliographic entry see Field 02L.
W72-04903

DAYLIGHT INCUBATOR ESTIMATES OF PRIMARY PRODUCTION IN THE MOUTH OF THE PATUXENT RIVER, MARYLAND,
Maryland Univ., Solomons. Natural Resources Inst.
For primary bibliographic entry see Field 02L.
W72-04904

ECOLOGY OF HETEROTROPHIC AEROBIC BACTERIA OF PLAYA LAKES AND MICROCOSMS,
Southern Colorado State Coll., Pueblo.
Robert W. Gorden, and Lucy B. Hill.
Southwest Natur. 15 (4): 419-428. 1971. Illus.
Identifiers: Aerobic, Bacteria, Ecology, Heterotrophic, Lakes, Microcosms, Phyto, Plankton, Playa, Waterfowl.

Playa lakes of the High Plains region receive runoff from well-defined watershed areas. Data are presented from a study of 2 playa lakes and microcosms developed from the lakes. Nutrient agar plate counts of viable populations ranged from 10 to the 4th power to 10 to the 6th power/ml in the lakes and to 10 to the 7th power/ml in the microcosms. Of 22 bacterial types isolated, 10 were actinomycetes-like and 9 of the 22 were chromogenic, gram-negative rods. No bacterial succession was observed in the lakes although a definite succession was present in the microcosms. Bacteria were apparently little affected by changes in water temperature, pH changes (from pH 7.0 to 8.2), or in water levels of the lakes. Uptake of 14C-U-glucose had value as a relative measure of heterotrophic activity and was closely related to viable plate counts of bacteria. Phytoplankton photosynthesis was negligible as based on uptake of NaH14CO3. Evidence was obtained for antibiotic production by an actinomycete isolate. Vascular plants covered approximately 75% of the playa dry lake bed. Following the influx of runoff, most of these plants were degraded, in part by microbial action. Thus, a food web was initiated which supported high numbers of animals, including water fowl. The playa lake ecosystems are highly productive and may represent an example of detritus agriculture.--Copyright 1971, Biological Abstracts, Inc.
W72-04905

EFFECTS OF PHOSPHORUS MINING WASTES ON THE GROWTH OF PHYTOPLANKTON IN THE PAMLICO RIVER ESTUARY,
Woods Hole Oceanographic Institution, Mass.
Edward J. Carpenter.
Chesapeake Sci. 12 (2): 85-94. 1971. Illus.
Identifiers: Anabaena-Torulosa, Biomass, Estuary, Growth, Mining, North Carolina, Pamlico, Phosphorus, Phyto, Plankton, River, Sewage, Spirulina, Wastes.

To test the effects of P mining waste water (SPW) and domestic sewage on the growth of phytoplankton in the Pamlico River estuary, six 1400 cu m artificial estuaries and eight 15 cu m plastic pools were constructed. Measurements of phytoplankton biomass and abundance of blue-green algae were made at regular intervals in estuaries and pools that contained various concentrations of SPW and artificial sewage. Concentration (excluding controls) of SPW in the pools was 1% and in the estuaries ranged from 2% to 8% of the total water volume. The concentration of an artificial sewage mix in the pools was 0.1% v/v. The present-day concentration of SPW in the lower Pamlico River is about 0.7% v/v and is expected to rise as other companies begin mining operations. Two experiments were carried out, one (44 days long) in the estuaries and one (36 days long) in the plastic pools. The experiments gave evidence that the addition of SPW to estuarine water does not immediately increase the biomass of the phytoplankton. This is most likely because P apparently does not limit the growth of phytoplankton in the river. As shown in a study that took place in late summer, N limited the algal photosynthesis in the Pamlico estuary. However, blue-green algae cell numbers (Anabaena sp. and Spirulina sp.) were 77.2% higher ($.010 < p < .025$) than controls in estuaries containing approximately 8% SPW v/v. Although cell numbers were 33.2% above controls in estuaries with 2% SPW SPW v/v, the difference was not statistically significant at the 5% level. Also, blue-green algae (Anabaena torulosa) numbers were 404% higher ($.010 < p < .025$) than controls in plastic pools with 1% SPW v/v and 295% above ($.010 < p < .025$) controls with 1% SPW and 0.1% v/v artificial sewage. The growth of blue-green algae was probably stimulated by the addition of P in the SPW, and their nitrogen fixing ability allowed them to obtain sufficient N in waters where this nutrient is otherwise limiting. This increase in blue-green algae may be potentially harmful to the estuary by changing the algal species composition and by adding fixed N to an estuary where photosynthesis is N limited. The addition of an artificial sewage mix (commercial fish food) to the plastic pools did not significantly affect the growth of phytoplankton. An analysis of the artificial sewage mix showed that the limiting nutrient N was apparently not in a form that was available to phytoplankton. This experiment showed that commercial fish food is apparently not an effective substitute for domestic sewage in enrichment bioassays.--Copyright 1971, Biological Abstracts, Inc.
W72-04906

COMPARATIVE STUDIES OF PEPTONE DEGRADATION AND THE CORRELATED POPULATION OF CILIATES IN MODELS OF FLOWING AND STAGNANT WATER,
Bonn Univ. (West Germany). Zoological Inst.
Hartmut Bick, and Walter Schmerenbeck.
Hydrobiologia. 37 (3/4): 409-446. 1971. Illus. English summary.
Identifiers: Bacteria, Ciliates, Comparative, Degradation, Flowing, Models, Peptone, Population, Sewage, Simulation, Stagnant.

The decomposition of peptone and the associated species numbers and individual counts of ciliates was investigated in flowing (current speed 40 cm/sec) and stagnant model ecosystems. In order to imitate the ecological conditions in natural waters receiving sewage small quantities of peptone were added at regular intervals. The most important environmental factors such as pH, dissolved O2, NH4+-, NO3-- levels, and the organisms occurring in free water as well as in the periphyton community on microscopic slides, were investigated for 3 wks. Both the population dynamics of organisms and the environmental conditions within the ecosystems were observed. The ecosystem with flowing water, and the aerated stagnant model showed high contents of O2 and fast mineralization of peptone up to the NO3--level. The unaerated model showed a retarded decomposition of peptone and accumulation of ammonia. The unaerated stagnant ecosystem showed the highest individual counts of bacteria and ciliates, while in the flowing model a limited number of organisms only was found. Most of the differences between flowing and stagnant waters are due to the varying O2-level. Only 2 spp. were directly inhibited by the current speed tested in these experiments.--Copyright 1971, Biological Abstracts, Inc.
W72-04909

ECOLOGY OF JUVENILE TARPON AND EFFECTS OF DIELDRIN ON TWO ASSOCIATED SPECIES,
Federal Water Pollution Control Administration, Washington, D.C.
Richard Archer Wade.
U S Bur Sport Fish Wildl Tech Pap. 41. 3-85. 1969. Illus.
Identifiers: Control, Cyprinodon-Variegatus, Dieldrin, Distribution, Ecology, Flies, Juvenile, Megalops-Atlanticus, Mosquitoes, Poecilia-Latipinna, Poisoning, Salinity, Species, Symptoms, Tarpon, Temperature.

Biocidal types, formulation, uses, quantities, applications, economic values, and relation to commercial and sport fishereies are briefly discussed. The chlorinated hydrocarbon compounds are ranked according to their relative toxicities to several species of fishes as reviewed in the literature. Distribution, persistence, and effects of dieldrin in freshwater and estuarine areas are presented. A constant-flow apparatus was constructed for bioassay testing. Accessory systems for regulating salinity pH, and temperature are described and illustrated. Methods olection, treatment, and acclimation of Cyprinodon variegatus and Poecilia latipinna used in the bioassays are described. A resume of bioassay methods describes the different techniques used in acute and chronic testing procedures. Discrepancies in toxicity values obtained for the same fish species, and for the same compound, are reported in the literature. Symptoms of dieldrin poisoning in C. variegatus, and P. latipinna are described. Behavior in both species indicated central nervous system disorders. Means and variances of 76, 48-hr TLm (Median tolerance limit) bioassays for the effects of dieldrin at 3 temperatures, 3 salinities, and 2 H ion concentrations are presented. A summary of analysis of variance for the 3 variables is made for each species. Comparison of the major variables shows that factors affecting the mean TLm for the 2 species are different. C. variegatus is primarily affected by the interactions of pH x salinity, pH x temperature, and salinity x temperature, while P. latipinna is most influenced by temperature. Interactions of pH x salinity appear secondary in influencing the TLm means for P. latipinnia; and salinity itself is of no statistical significance for this species. The temperature factor, so important for P. latipinna, is of little statistical importance for C. variegatus except when combined with low salinities. Distribution of the larvae and juveniles of Megalops atlanticus is reviewed. New information is presented on the habitats of the juvenile tarpon and associated species. Major physical alterations affecting tarpon habitats include dredging, filling, impounding, and ditching. These modifications are illustrated in a series of aerial photographs. Many of these are used for control of mosquitoes and flies and for land development. These operations unless controlled will destroy the major tarpon nursery areas. Juveniles of M. atlanticus have been found in waters ranging from 12 deg to 40 deg C in temperature, from 0 to 47 ppt. in salinity, and in pH from 6.8 to 8.2, over locations along the shores of south Florida, from Sebastian Inlet southward on the east coast, and from Tampa southward on the west coast of Key West.--Copyright 1971, Biological Abstracts, Inc.
W72-04927

OXYTETRACYCLINE RESIDUES IN DIFFERENT TISSUES OF TROUT,
Bureau of Sport Fisheries and Wildlife, Kearneysville, W. Va.
R. L. Herman, Diane Collis, and G. L. Bullock.
U S Bur Sport Fish Wildl Tech Pap. 31/40. 1-6. 1969. Illus.
Identifiers: Cooking, Oxytetracycline, Residues, Tissues, Trout.

Oxytetracycline, as TM-50, was fed to rainbow, brook and brown trout held at 3 temperatures, 6-7 deg, 9-10 deg, and 12-13 deg C. Tissues were assayed to determine excretion rates. The greatest concentration was found in liver, then muscle, plasma, and kidney. Residues were undetectable in the muscle, plasma, and kidney in 10 to 14 days at 12-13 deg C, and in muscle at 9-10 deg C but 4 wk were required for these tissues to clear at 6-7 deg C. Liver took 30 days to clear at 12-13 deg C. More than 35 days were required at 6-7 deg C. Cooking generally destroyed the residues in muscle.--Copyright 1971, Biological Abstracts, Inc.
W72-04928

OXYTETRACYCLINE EFFICACY AS A TREATMENT FOR FURUNCULOSIS IN COHO SALMON,
Bureau of Sport Fisheries and Wildlife, Seattle, Wash.
Donald F. Amend.
U S Bur Sport Fish Wildl Tech Pap. 31/40. 1-6. 1969.
Identifiers: Aeromonas-Salmonicida, Anti, Coho, Furunculosis, Infect-Drug, Oncorhynchus-Kisutch, Oxytetracycline, Salmon, Treatment.

Coho salmon (Oncorhynchus kisutch) were infected with Aeromonas salmonicida (furunculosis) and treated with oxytetracycline at different stages of disease severity to determine the drug efficacy. The disease was controlled but the degree of control depended on when treatment started. The longer treatment was delayed after infection, the less effective was the treatment. However, it was concluded that feeding 3.5 g oxytetracycline per 100 lb. of fish per day for 10 days was an effective way of controlling furunculosis in coho salmon.--Copyright 1971, Biological Abstracts, Inc.
W72-04929

OXYTETRACYCLINE EFFICACY AS A PRETREATMENT AGAINST COLUMNARIS AND FURUNCULOSIS IN COHO SALMON,
Washington Univ., Seattle. Coll. of Fisheries.
Donald Curran, and R. L. Herman.
U S Bur Sport Fish Wildl Tech Pap. 31/40. 1-6. 1969.
Identifiers: Aeromonas-Salmonicida, Anti, Chondrococcus-Columnaris, Coho, Columnaris, Furunculosis, Infect-Drug, Oxytetracycline, Pre, Salmon, Treatment.

Coho salmon fed 100 milligrams oxytetracycline per kilogram/day beginning 3 days before exposure to pathogens were protected against infection by Chondrococcus columnaris and drug sensitive Aeromonas salmonicida. Over 10,000 times as many A. salmonicida organisms were required to kill pre-treated coho salmon as those not treated.--Copyright 1971, Biological Abstracts, Inc.
W72-04930

OXYTETRACYCLINE TOXICITY TO TROUT,
Bureau of Sport Fisheries and Wildlife, Kearneysville, W. Va.
R. L. Herman.
U S Bur Sport Fish Wildl Tech Pap. 31/40. 1-4. 1969.
Identifiers: Hatchery, Oxytetracycline, Toxicity, Trout.

The information presented indicates oxytetracycline has a low toxicity to trout and under hatchery conditions it is probably impossible to feed lethal levels.--Copyright 1971, Biological Abstracts, Inc.
W72-04931

OXYTETRACYCLINE SENSITIVITY OF SELECTED FISH PATHOGENS,
Bureau of Sport Fisheries and Wildlife, Kearneysville, W. Va.
G. L. Bullock, and Diane Collis.
U S Bur Sport Fish Wildl Tech Pap. 31/40. 1-9. 1969. Illus.
Identifiers: Anti, Bacteria, Fish, Infect-Drug, Infecting, Oxytetracycline, Pathogens, Selected, Sensitivity.

Selected representatives of several genera of gram-negative fish pathogenic bacteria were tested for in vitro and in vivo sensitivity to oxytetracycline hydrochloride (Terramycin). In vitro results indicated that concentrations of the antibiotic required to inhibit growth of the pathogens were below those toxic to the fish. In vivo results showed that oxytetracycline would prevent mortalities among trout injected with pathogenic bacteria while infected but not treated control trout died from the infecting bacteria.--Copyright 1971, Biological Abstracts, Inc.
W72-04932

OXYTETRACYCLINE IN FISH CULTURE: A REVIEW,
Bureau of Sport Fisheries and Wildlife, Kearneysville, W. Va.
R. L. Herman.
U S Bur Sport Fish Wildl Tech Pap. 31/40. 1-9. 1969.
Identifiers: Anti, Culture, Disease, Fish, Growth, Infect-Drug, Marking, Oxytetracycline, Review, Skeletal, Toxicity, Treatment.

A review of literature is made on the use of oxytetracycline in fish culture. Subjects include growth promotion, disease treatment, toxicity, and skeletal marking.--Copyright 1971, Biological Abstracts, Inc.
W72-04933

SURVIVAL AND HATCHING OF WALLEYE EGGS AT VARIOUS DISSOLVED OXYGEN LEVELS,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
Donavon M. Oseid, and Lloyd L. Smith, Jr.
Progr Fish-Cult. 33 (2): 81-85. 1971. Illus.
Identifiers: Dissolved, Eggs, Hatching, Oxygen, Survival, Temperature, Walleye.

Walleye eggs were hatched at varying levels of O2 from 2 to 7 ppm and at temperatures from 12.1 deg to 13.2 deg C. Length of incubation period variety from 19 days at 7 ppm DO (dissolved oxygen) to 22 days at 3 ppm and 12.4 deg C. At 2 and 4 ppm DO and 13.2 deg C. hatching was complete in 18 and 15 days, respectively. The length of fry at hatch was 5.8 to 12.9% shorter at lower O2 levels than at higher O2 levels. When eggs are hatched at low temperatures, the difference between different O2 levels becomes greater. Data suggest that the optimum level for hatching is not lower than 5 to 6 ppm DO.--Copyright 1971, Biological Abstracts, Inc.
W72-04935

A PARASITE AND DISEASE SURVEY OF CONNECTICUT OYSTERS,
National Marine Fisheries Service, Oxford, Md. Biological Lab.
Martin W. Newman.
Proc Nat Shellfish Ass. 61: 59-63. 1971. Illus.
Identifiers: Connecticut, Crassostrea-Virginica, Disease, Disorder, Minchinia-Costalis, Minchinia-Nelsoni, Neoplasm, Ova, Oysters, Parasite, Survey.

Histologic sections of 1337 oysters, Crassostrea virginica, from New Haven Harbor, Connecticut, were examined for the presence of parasites and disease. Seven parasites were found, including types resembling plasmodia of Minchinia costalis and M. nelsoni. One oyster was found with a neoplasm and 7 others with a disorder of the ova of unknown etiology. There was no evidence of any disease epizootic in the New Haven area, although one moribund oyster was found to be heavily infected with plasmodia of the M. costalis type.--Copyright 1971, Biological Abstracts, Inc.
W72-04939

SETTING, GROWTH AND MORTALITY OF CRASSOSTREA VIRGINICA IN A NATURAL MARSH AND A MARSH ALTERED BY A HOUSING DEVELOPMENT,
National Marine Fisheries Service, Galveston, Tex. Biological Lab.
Donald Moore, and Lee Trent.
Proc Nat Shellfish Ass. 61: 51-58. 1971. Illus. Map.
Identifiers: Blooms, Crassostrea-Virginica, Dermocystidium-Marinum, Development, Fish, Growth, Housing, Kills, Marsh, Minerals, Mortality, Natural, Plankton, Setting, Temperature.

In Feb. 1969, asbestos plates for collecting oyster spat and partitioned trays containing 8 size groups

of juvenile oysters were placed in a dead-end canal in a housing development created by dredging, bulkheading, and filling part of a coastal marsh; and a deadend bayou in an unaltered part of the same marsh in West Bay, Texas. The plates and juvenile oysters were then monitored periodically for the next 12 mo. Temperature, salinity, dissolved O2, total P, inorganic phosphatephosphorus, Kjeldahl N, nitrite, turbidity, pH, CO2, total alkalinity and carbonate alkalinity were monitored in the water at both locations. Eight of the above variables were compared to the growth and mortality of the juvenile oysters. Spat set from late May until Oct. 1969, with the greatest settlement in Sept. Although never heavy, setting was 14 times greater in the marsh than in the altered area. Juvenile oysters grew faster in the marsh than in the altered area. Within each site the individual size groups increased in mean length at similar rates. The average increase in length was 52 mm/year in the natural marsh and 33 mm/year in the altered area. The average increase in weight was 136 g/year in the natural area and 86 g/year in the altered area, and was greatest in the largest size group in both areas. Mortality rates of juveniles were similar among all size groups in the development and greatest among the largest size groups in the marsh. The annual rate of mortality averaged 91% in the altered area and 52% in the natural area. Dermocystidium marinum was not detected in three spot checks during June, July and Aug. Greatest differences in spatfall, growth and mortality between areas were in the summer when dissolved oxygen was lower in the narrow-end canals in the altered area. Also several plankton blooms followed by very low O2 and then fish kills occurred in the canal during the summer.--Copyright 1971, Biological Abstracts, Inc.
W72-04940

SETTING OF THE AMERICAN OYSTER RELATED TO ENVIRONMENTAL FACTORS AND LARVAL BEHAVIOR,
Maine Univ., Walpole. Ira C. Darling Center for Research, Teaching and Service.
Herbert Hidu, and Harold H. Haskin.
Proc Nat Shellfish Ass. 61: 35-50. 1971. Illus. Maps.
Identifiers: American, Behavior, Crassostrea-Virginica, Environmental, Larval, Oyster, Salinity, Setting, Temperature.

Factors were defined which may be important in producing the consistently heavy oyster, Crassostrea virginica (Gmelin), setting on the Delaware Bay tidal flats along the west coast of the Cape May Peninsula. A transect of 12 stations extending 4/5 mile offshore measured setting over 2 seasons with cement-board panels placed throughout the water column. Oysters set heavily at the very inshore intertidal area and also 1/2 mi. offshore at a slope which bounds the flats from deeper water. The slope setting area coincided with heavy concentration of mature larvae. At the inshore area, similar setting rates were associated with only a tenth of the slope larval concentration indicating existence of factors promoting stimulation of set. The offshore slope was the area of steepest gradient in current velocity. The most inshore area was characterized by relatively great salinity and temperature increase with flood tides. Laboratory-reared oyster larvae, when subjected to salinity and temperature increases as experienced inshore, were stimulated to set in response to the temperature, but not the salinity factor. A gregarious tendency in setting, however, reduced the significance of these findings. Individual cultch shells were not differentially 'preferable' in oyster setting. However, the presence of spat on cultch shells attracted and stimulated setting. The offshore slope area may be important in the primary concentration of larvae. Inshore setting probably is promoted by factors which may stimulate setting, such as temperature increases and the presence of oyster populations which may promote a gregarious response.--Copyright 1971, Biological Abstracts, Inc.
W72-04941

HOLDING AND SPAWNING DELAWARE BAY OYSTERS (CRASSOSTREA VIRGINICA) OUT OF SEASON: II. TEMPERATURE REQUIREMENTS FOR MATURATION OF GONADS,
Delaware Univ., Lewes. Coll. of Marine Studies.
Kent S. Price, Jr., and Don Maurer.
Proc Nat Shellfish Ass. 61: 29-34. 1971.
Identifiers: Bay, Crassostrea-Virginica, Delaware, Gonads, Hatchery, Holding, Maturation, Oysters, Season, Spawning, Temperature.

Spawning responses are reported for seven lots of Delaware Bay Oysters (nearly 400 individuals) held in the laboratory at temperature ranging from 11.6-29.4 deg C for periods ranging from 28-248 days. Histological studies of gonadal ripening were conducted on 2 of the lots of laboratory held oysters and on 1 lot held at temperatures in the field as a control. Based on the histological examination of oyster gonads and spawning responses as related to the thermal history of the laboratory held oysters, a temperature-time schedule is proposed that should allow one to hold, condition and spawn Delaware Bay oysters in the laboratory or a hatchery on a year-round basis. These oysters required from 6 to 7 times as long to ripen as Long Island oysters at temperatures between 12.0 and 22.0 deg C. Within this range of temperature, 450 degree days (sum of the daily exposure temperatures above 12.0 deg C) were required to elicite spawning in at least 50% of the oysters tested.--Copyright 1971, Biological Abstracts, Inc.
W72-04942

CHEMICAL STIMULANTS AFFECTING LARVAL SETTLEMENT IN THE AMERICAN OYSTER,
Delaware Univ., Lewes. Coll. of Marine Studies.
Richard Keck, Don Maurer, James C. Kauer, and William A. Sheppard.
Proc Nat Shellfish Ass. 61: 24-28. 1971.
Identifiers: American, Chemical, Crassostrea-Virginica, Larval, Liquor, Oyster, Settlement, Shell, Stimulants.

Laboratory experiments confirmed that the presence of spat on shells stimulated spatfall of the American oyster (Crassostrea virginica Gmelin) and prompted a search for the mechanism of the stimulation. Shell liquor, feces and pseudofeces of the oyster were assayed for presence of natural set stimulants. Highest activity was found in shell liquor which was then subjected to separation techniques including lyophilization and ether extraction to concentrate the set stimulant. The lyophilized residue and an ether extract of oyster liquor as well as a commercial sample of 'shellfish glycogen' were found to have a high set stimulant activity.--Copyright 1971, Biological Abstracts, Inc.
W72-04943

THE ELIMINATION OF BACTERIA BY THE NORTHERN QUAHOG: VARIABILITY IN THE RESPONSE OF INDIVIDUAL ANIMALS AND THE DEVELOPMENT OF CRITERIA,
Northeastern Water Hygiene Lab., Narragansett, R.I.
W. Paul Heffernan, and Victor J. Cabelli.
Proc Nat Shellfish Ass. 61: 102-108. 1971. Illus.
Identifiers: Animals, Bacteria, Criteria, Development, Elimination, E. coli, Individual, Northern, Polluted, Quahog, Variability.

Trials were performed to determine the distributions of residual coliform levels in individual quahogs following depuration. The distributions were dependent on the initial level of contamination in the animals and on the manner by which they were polluted, i.e., artificially with cultures of Escherichia coli as opposed to naturally in polluted waters. From the data obtained with the naturally polluted animals, a monitoring system for the depuration process and some tentative target residual levels were developed for further evaluation of the process with 'moderately polluted' animals. This was accomplished in 15 trials which showed that, following depuration of moderately polluted quahogs, a product could be produced which, in terms of these coliform organisms, was a good or better than that currently accepted from approved areas.--Copyright 1971, Biological Abstracts, Inc.
W72-04944

SEASONAL FACTORS RELEVANT TO COLIFORM LEVELS IN THE NORTHERN QUAHAUG,
Northeastern Water Hygiene Lab., Narragansett, R.I.
Victor J. Cabelli, and W. Paul Heffernan.
Proc Nat Shellfish Ass 61: 95-101, 1971. Illus, Map.
Identifiers: Coliform, Escherichia-Coli, Low, Mercenaria-Mercenaria, Northern, Polluted, Quahog, Relevant, Seasonal, Temperature.

Few coliform organisms can be recovered from the northern quahaug, Mercenaria mercenaria, when the water temperature falls below 10 deg C for considerable periods of time, even though they are growing in heavily polluted waters. This could be due to a more marked effect of low temperatures on microbial uptake as contrasted to elimination, resulting in a gradual decrease in the coliform levels in the animals. A 2nd possibility is death of the organisms within the animal. In the work reported, the effect of seasonal changes on the presence of fecal coliforms in animals from a polluted area is documented. The greater inhibitory action by temperatures of 10 deg C and lower and by turbidities above 10 Jackson Turbidity Units on uptake as compared to elimination of Escherichia coli by the quahaug is demonstrated. Data on the effect of temperature and turbidity changes on the experimental uptake and elimination of E. coli by the animal are presented. Possible bases for these differences are discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-04945

ACCUMULATION AND ELIMINATION OF COLIPHAGE S-13 BY THE HARD CLAM, MERCENARIA MERCENARIA,
Rutgers - The State Univ., New Brunswick, N.J. Oyster Research Lab.
Walter J. Canzonier.
Appl Microbiol. 21 (6): 1024-1031. 1971.
Identifiers: Accumulation, Clam, Coli, Depuration, Digestive, Elimination, Escherichia-Coli, Gland, Hard, Mercenaria-Mercenaria, Phage, S-13, Shellfish, Temperature, Tissue, Titer.

Accumulation and elimination of viral particles by hard clams, M. mercenaria, was studied with the coliphage S-13 as a working model. Escherichia coli uptake and elimination were simultaneously monitored. Clams were exposed to low levels of S-13 (7 particles/ml) in running seawater for several days achieving titers in tissues from 2 to 1000 times the levels to which they had been exposed. Bacterial accumulation was comparable. Upon exposure to virus-free running water, clams polluted to relatively low levels (100 plaque-forming units/ml) eliminated most of their bacterial contaminants in 24 to 48 hr. Viral contaminants, however, persisted from day to wk even under ideal conditions for clam activity when the temperature remained below the inactivation threshold for the virus. Most of the accumulated virus was sequestered in the digestive gland. These sequestered particles are refractory to those mechanisms which eliminate bacterial contaminants. The need for caution in evaluating the efficiency of shellfish depuration processes, especially if only a bacterial criterion is used as a monitoring system, is shown.--Copyright 1971, Biological Abstracts, Inc.
W72-04953

TOXICITY AND OXYGEN DEMAND OF DECAYING BARK,
International Pacific Salmon Fisheries Commission, Cultus Lake (British Columbia).

James A. Servizi, Dennis W. Martens, and Robert W. Gordon.
J Water Pollut Contr Fed 43 (2): 278-292, 1971. Illus.
Identifiers: Alevins, Alpine, Bark, Decaying, Douglas-Fir-G, Fir, Leachate, Oxygen, Pine-G, Salmon, Sockeye, Sphaerotilus, Spruce-G, Toxicity.

Bioassays using sockeye salmon eggs and alevin showed that chemical toxicity of leachates from the bark of Douglas fir, Lodgepole pine, Englemann spruce, and Alpine fir was not a factor in assessing the effect of bark contamination on salmon spawning grounds. However, the contamination of gravel with bark caused significant reductions in survival from egg to fry at bark concentrations of 10% by volume. Statistical comparison indicated that 1% bark concentrations did not influence survival. Mortalities were attributed to the blockage of intragravel water flow by block particles. The O2 demand of the decaying bark was relatively constant with time during the 683-day study. Abundant growth of Sphaerotilus occurred on the bark during the initial stages of decay causing suffocation among sockeye eggs and alevins. Calculations using O2 demand indicated the amount of O2 that would remain for egg incubation at various temperatures and levels of bark contamination.--Copyright 1971, Biological Abstracts, Inc.
W72-04957

FACTORS INFLUENCING SCOPE FOR ACTIVITY AND ACTIVE AND STANDARD METABOLISM OF RAINBOW TROUT (SALMO GAIRDNERI),
Department of Mines and Natural Resources, Winnipeg (Manitoba).
I. W. Dickson, and R. H. Kramer.
J Fish Res Bd Can. 28 (4): 587-596, 1971.
Identifiers: Metabolism, Rainbow, Salmo-Gairdneri, Scope, Standard, Starvation, Temperature, Trout.

Scope for activity was similar for hatchery and wild S. gairdneri, except at 25 C where values for wild trout were significantly higher than those for hatchery trout. In hatchery and wild rainbow trout, respectively, scope for activity was highest at 15 and 20 C. Active metabolism increased with temperature to 570 and 592 mg O2/kg per hr at 15 and 20 C, respectively. At 25 C, active metabolic rates of wild trout were higher than those for hatchery trout. In hatchery and wild trout, respectively, standard metabolism increased from 36 and 42 mg O2/kg per hr at 5 C to 138 and 120 mg O2/kg per hr at 25 C. Scope for activity of hatchery trout was highest after 6 days starvation. Starvation had no effect on active metabolism of hatchery trout, but decreased their standard metabolism after 2 days. Scope for activity and active and standard metabolism of wild trout were similar during forenoon to those during afternoon when light simulated natural day and night and also when lighting was constant for 24 hr. Active metabolism of hatchery was higher during the spawning period than other periods of the year and was consistently the higher for males throughout the year.--Copyright 1971, Biological Abstracts, Inc.
W72-04958

HISTOLOGICAL COMPARISONS OF THE ADRENAL-CORTICAL CELLS OF HATCHERY AND WILD LANDLOCKED ATLANTIC SALMON (SALMO SALAR),
Maryland Univ., La Vale. Natural Resources Inst.
Robert M. Davis, and Owen C. Fenderson.
J Fish Res Bd Can 28 (4): 505-508, 1971.
Identifiers: Adrenal, Atlantic, Behavior, Cells, Cortical, Environmental, Hatchery, Histological, Landlocked, Salmo-Salar, Salmon, Stress, Wild.

No differences were found in mean diameters of adrenal-cortical cell nuclei between hatchery parr of landlocked S. salar killed immediately after removal from hatchery rearing pools and wild parr electrofished in 2 streams, and between hatchery and wild parr held for various periods in an outdoor stream aquarium simulating natural conditions. The similarities suggested that the wild and hatchery parr were similar in physiological response to environmental stress. In both hatchery and wild parr, the diameters differed at different times, indicating a downward trend from May to Aug. in the 1st year of the study. No consistent relation was found between nucleus diameter and social behavior.--Copyright 1971, Biological Abstracts, Inc.
W72-04960

SOME QUANTITATIVE ALGAL STUDIES OF THE RIVER THAMES,
Barbara Bowles, and Shelia Quennell.
Water Treat Exam 29 (1): 35-48, 1971.
Identifiers: Algal, England, Quantitative, River, Thames.

The present investigations were made with particular reference to the contributions of tributaries in order to determine more precisely their influence on the biological condition of the Thames.--Copyright 1971, Biological Abstracts, Inc.
W72-04963

LIMNOLOGICAL STUDIES OF THE LAKES AND STREAMS OF THE UPPER QU,APPELLE RIVER SYSTEM, SASKATCHEWAN, CANADA: I. CHEMICAL AND PHYSICAL ASPECTS OF THE LAKES AND DRAINAGE SYSTEM,
Univ. Saskatchewan, Saskatoon, Sask., Can. Biol. Dep.
U. T. Hammer.
Hydrobiologia. 37 (3/4): 473-507. 1971. Illus. German summary.
Identifiers: Canada, Chemical, Drainage, Lakes, Limnological, Physical, Qu-Appelle, River, Saskatchewan, Sewage, Soils, Streams, System, Vegetation.

Physical aspects including geography, geology, climate, soils, vegetation and lake morphometry of the upper Qu'Appelle River basin have been summarized. The importance of multiple use of this area has been stressed. The lakes were studied during the 1959-1969 period. Only Katepwa Lake showed temperature stratification for any length of time. Ice cover persisted for about 5 mo. each year. Buffalo Pound Lake had the lowest mean Secchi disc transparency (0.9 m) while Katepwa Lake had the highest (2.1 m). Light transmissibility tended to be lowest during May and Sept. when wind velocities were highest. The 1% level of light extinction was usually between 1 and 3 meters depth. The yellow portion of the spectrum penetrated the furthest. Buffalo Pound Lake was the least saline (600-700 mg/l TDS (Total dissolved solids) while Last Mountain Lake was most saline (2000-2400 mg/l TDS). Input from Lake Diefenbaker and heavy spring run-offs effected major decreases in all lakes by May, 1969. All lakes except Last Mountain were considerably more saline than during the 1937-1941 period. Variations in anions and cations within and between lakes vary with the total dissolved solids. As salinity increases Mg, sulfate and chloride increase faster proportionally than other ions. The order of concentration of major cations is Na>Mg>Ca>K while the major anions' order of concentrations is SO4>CO3.HCO3>Cl. Soluble phosphate levels tend to be lowest in Buffalo Pound Lake. Levels increased sharply in Pasqua Lake below sewage outfalls from Moose Jaw and Regina. Subsequently levels decreased in each successive down-stream lake. Concentrations increased during the period of study. It was estimated that 594 metric tons of orthophosphate were contributed in domestic sewage in 1966. In addition land drainage contributes considerable amounts of phosphate during spring runoff. Nitrogen-bearing compounds vary in similar patterns as soluble phosphate but with smaller fluctuations. Domestic sewage and land drainage contribute significant amounts but of greater importance may be in situ biological fixation. All lakes were basic with usual pH of 8.4-9.0. From a chemical point of view these lakes are distinctly eutrophic.--Copyright 1971, Biological Abstracts, Inc.
W72-04975

ORGANOCHLORINE INSECTICIDE RESIDUES IN FISH-FALL 1969: NATIONAL PESTICIDE MONITORING PROGRAM,
Bureau of Sport Fisheries and Wildlife, Washington, D.C. Div. of Fishery Research.
For primary bibliographic entry see Field 05A.
W72-04982

SOME EFFECTS OF TEMPERATURE AND OXYGEN CONCENTRATION ON PHYLLOPOD ECOLOGY,
Southwest Texas State Univ., San Marcos. Dept. of Biology.
Francis R. Horne.
Ecology. 52 (2): 343-347. 1971. Illus.
Identifiers: Brachinecta-Packardi, Caenestheriella-Setosa, Concentration, Ecology, Oxygen, Phyllopod, Streptocephalus-Texanus, Temperature, Triops-Longicaudatus.

Seasonal distributional patterns of 5 phyllopods from southwest Texas are similar to those of the same species from more northern latitudes. At both latitudes a primary environmental cue controlling the appearance of phyllopods seems to be temperature. For instance, in Texas Branchinecta packardi was the only cold water species. In addition to the effects of temperature on phyllopod zoogeography, diurnal studies show that high temperatures contribute both directly and indirectly to O2 depletion in temporary ponds. The comparative tolerance of phyllopods to near anaerobic conditions was as follows: clam shrimp, Caenestheriella setosa > tadpole shrimp, Triops longicaudatus > fairy shrimp, Streptocephalus texanus.--Copyright 1971, Biological Abstracts, Inc.
W72-04988

COMBINED HIGH SPEED LIQUID CHROMATOGRAPHY AND BIOASSAY FOR THE EVALUATION AND ANALYSIS OF AN ORGANOPHOSPHORUS LARVACIDE,
Du Pont de Nemours (E. I.) and Co., Wilmington, Del.
For primary bibliographic entry see Field 05A.
W72-04997

PRIMARY PRODUCTION IN A TROPICAL FISH POND AT ALIGARH, INDIA,
Aligarh Muslim Univ. (India). Dept. of Zoology.
Asif A. Khan, and A. Qayyum Siddiqui.
Hydrobiologia. 37 (3/4): 447-456. 1971.
Identifiers: Aligarh, Bacterial, Fish, Fluctuation, Growth, India, Photosynthesis, Pond, Primary, Production, Seasonal, Tropical.

Seasonal fluctuations in gross and net primary production values were quite apparent in surface waters and showed a bimodal type of distribution. The values were generally high during post winter months (March to May) and low during winter (Feb.) and monsoon months (July and Aug.). At different depths the rate of primary production was always found decreasing from surface to bottom. The rate of photosynthesis was highly variable from time to time and at different depths. Respiratory rate was increasing from surface to bottom perhaps due to decomposition of organic matter and high bacterial growth at the increasing depths. A close relationship was found between the transparency and primary production values. Phosphate-phosphorus was directly related with the gross primary production values. However, there was no relationship between nitrate-nitrogen and production values. An inverse relationship was shown between ammonia-nitrogen and the production values. Fluctuations in chlorophyll were also significantly related with the gross pri-

mary production.--Copyright 1971, Biological Abstracts, Inc.
W72-05000

WATER, NITROGEN AND PHOSPHORUS IN FRESHWATER PLANKTON,
Aligarh Muslim Univ. (India). Dept. of Zoology.
A. Qayyum Siddiqui.
Hydrobiologia. 37 (3/4): 531-536. 1971. Illus.
Identifiers: Nitrogen, Phosphorus, Plankton, Thermocyclops-Hyalinus.

Mixed phytoplankton, zooplankton and Thermocyclops hyalinus collected from Fort Moat, at Aligarh, India, were analyzed for water, N and P. Results are generally in agreement with observations of earlier investigators. P values were very high. Nutritional condition of zooplankton improved during phytoplankton maxima in the lake.--Copyright 1971, Biological Abstracts, Inc.
W72-05009

SHALLOW AQUATIC BIOTOPES AS LIMNOLOGICAL MODELS,
Hydrobiological Research Station, Madras (India).
A. Sreenivasan.
Hydrobiologia. 37 (3/4): 553-564. 1971. Illus.
Identifiers: Algae, Biotopes, Desmids, Limnological, Models, Oxygen.

Four types of waters were studied as limnological models. Kodaikanal lake is characterized by low dissolved salts, poor plankton consisting mostly of desmids, and low primary production. Changes in alkalinity, pH, dissolved oxygen (DO), diurnally or vertically are insignificant. In another cold water upland lake productivity is high, a dense bloom of blue green algae contributing to much photosynthesis. Wide diurnal and depth variations occur in non-conservative parameters like pH, DO and alkalinity. O2 depletions in the bottom are severe and anoxic conditions also result. 'Producer' activities are overshadowed by 'reducer' and 'consumer' activities. The most productive water is Ayyankulam pond, where very wide diurnal variations in DO and alkalinity occur. More than 260% saturations of DO are noted. The pH variation is not equally high probably due to high buffering. O2 deficits in the bottom water are common. Blooms of Cyanophyceae occur throughout the year. The large irrigation tank is fairly productive and changes are moderate. Metabolism rates in these 4 ponds very well correlate with primary production and also with the other chemical parameters. Orthograde O2 curve is a characteristic of oligotrophic, low productive water. Klinograde O2 curve with O2 deficit at the bottom is characteristic of eutrophic productive waters. Here hypolimnial accumulation of free CO2 and bicarbonates also occurs. Permanent blooms of blue green algae occur in hypereutrophic waters.--Copyright 1971, Biological Abstracts, Inc.
W72-05023

EFFECTS OF SILTATION AND COARSER SEDIMENTS ON DISTRIBUTION AND ABUNDANCE OF STREAM-INHABITING INSECTS,
Idaho Univ., Moscow. Water Resources Research Inst.
M. A. Brusven, and K. V. Prather.
Available from the National Technical Information Service as PB-207 349, $3.00 in paper copy, $0.95 in microfiche. Idaho Water Resources Research Institute, Moscow, Technical Completion Report, September 1971. 67 p, 9 fig, 1 plate, 11 tab, 50 ref, append. OWRR A-026-IDA (1).

Descriptors: *Sedimentation, *Streams, *Water pollution effects, *Aquatic animals, *Idaho, Ecology, Ecosystems, Sediment transport, Particle size, Benthic fauna, Insects, Water chemistry, Biomass, Aquatic habitats, Silting, Evaluation.
Identifiers: *Sedimentation effects.

Sands and coarser sediments affect the distribution and abundance of insects in Emerald Creek and the Middle Fork of the St. Maries River in Idaho. Stream profile, substrate conditions, water chemistry and benthos were measured at seventeen permanent stations. Substrate simulation studies were conducted in an artificial stream in the laboratory to better define the relationship of substrate to five species of aquatic insects. Coarse and fine gravels with unimbedded cobble were preferred over fine sands and silt with partially or completely imbedded cobble by most insects. Habitats with few cobble and large amounts of sand and silt had low species diversities and biomass. Abnormal sediment production from rockhounding, dredge mining, and roadbuilding cause adverse effects on the stream environment and insects. (Woodard-USGS)
W72-05024

PHOTOSYNTHETIC PROPERTIES AND GROWTH OF PHOTOSYNTHETIC SULFUR BACTERIA IN LAKES,
Fisheries Research Board of Canada, Nanaimo (British Columbia). Biological Station.
Masayuki Takahashi, and Shun-Ei Ichimura.
Limnol Oceanogr. 15 (6): 929-944. 1970. Illus.
Identifiers: Bacteria, Growth, Lakes, Photosynthetic, Sulfur.

The photosynthesis-light curve for purple S bacteria had a steeper inclination than that for green S bacteria at low light intensities. Light saturation occurred at intensities of 5-7 klux in the former, in the latter at 10-30 klux. Light inhibition was observed in purple S bacteria but was negligible in green S bacteria. The optimal temperature for photosynthesis of these bacteria is considerably higher than that of most phytoplankton or green plants. Photosynthetic S bacteria appear ordinarily in the contact layer between oxidative and reductive zones of meromictic or stagnant holomictic lakes; the light intensity in this contact layer is usually less than 10% of that at the surface. On the assumption that the photosynthetic rate of these bacteria is limited mainly by the interaction of H2S concentration with light intensity, their growth was analyzed with a mathematical model. The properties of the growth phase observed in lakes were similar to those calculated. The main factors determining the growth of photosynthetic S bacteria in lakes are the H2S concentration in the upper layer and the light conditions in the deeper layer.--Copyright 1971, Biological Abstracts, Inc.
W72-05085

BIBLIOGRAPHY OF AQUACULTURE.
Coastal Plains Center for Marine Development Services, Wilmington, N.C.

Center Publication No 71-4, September 1971. 245 p.

Descriptors: *Fish farming, *Aquiculture, *Mollusks, *Crustaceans, Fish management, Environmental effects, Sediments, Impoundments, Reservoirs, Ponds.
Identifiers: *Aquaculture, *Mariculture.

Aquaculture, the cultivation of aquatic organisms, deals with the culture of salt water fish, freshwater fish, mollusks, and crustaceans in ponds, impoundments, and in the case of mollusks, in open bays and seas. The basic orientation of the bibliography is biological and technical with the selection of foreign references limited to those pertinent to similar geographical, climatic, and consumer food preference conditions. 787 references are cited by author alphabetically under three broad areas of: culture of marine and fresh water fishes, crustaceans, and mollusks. There is an author index and a permuted title index.
W72-05087

TEMPERATURE REQUIREMENTS OF SALMONIDS IN RELATION TO THEIR FEEDING, BIOENERGETICS, GROWTH, AND BEHAVIOR.
Oregon State Univ., Corvallis. Water Resources Research Inst.

Available from the National Technical Information Service as PB-207-137, $3.00 in paper copy, $0.95 in microfiche. Summary Progress Report, January 1, 1972. 23 p, 8 fig, 2 tab. OWRR B-012-ORE (1) and B-027-ORE (1).

Descriptors: Heated water, Fish reproduction, Temperature, Aquatic life, Chinook salmon, Model studies, Trout, Salmon, Water quality, Geothermal studies.

Laboratory studies are designed to define, in terms of food consumption, bioenergetics, and growth of fish, the temperature conditions to which fish can adapt physiologically. The model stream studies simulate conditions of elevated temperature to which fish and other organisms may be exposed in natural streams. The stream experiments are designed to evaluate--the effects of a modified temperature regime on important ecological relationships in an aquatic community. Evaluations were made on the basis of differences in the behavior, food relations, growth, and production of salmon, and differences in the abundance of plants and invertebrates in a heated and a control stream. Phase I of the study, terminated in July, 1971, examined the effects of elevated temperature on juvenile coho salmon. During Phase II model stream and laboratory studies will evaluate the response of juvenile chinook salmon, Oncorhynchus tshawytscha, to elevated temperatures. Laboratory studies with juvenile steelhead trout, Salmo gairdneri, will permit comparison of the temperature response of this species with that of the Pacific salmon.
W72-05090

THE MILL RIVER AND ITS FLOODPLAIN IN NORTHAMPTON AND WILLIAMSBURG, MASS.: A STUDY OF THE VASCULAR PLANT FLORA, VEGETATION, AND THE PRESENCE OF THE BACTERIAL FAMILY PSEUDOMONA--DACEAE IN RELATION TO PATTERNS OF LAND US E,
Massachusetts Univ., Amherst. Water Resources Research Center.
Elizabeth D. Robinton, and C. John Burk.
Available from the National Technical Information Service as PB-207 127, $3.00 in paper copy, $0.95 in microfiche. Massachusetts Water Resources Research Center, Amherst, Completion Report 72-4. 72 p, 3 fig, 11 tab, 13 ref. OWRR A-026-MASS (1).

Descriptors: *Pseudomonas, Pollution abatement, *Land use, Succession, *California, *Floodplains, Massachusetts, Water pollution effects, Aquatic plants, Industrial wastes, *Marsh plants.
Identifiers: *Mill River (Mass), Diversity, Marsilea quadrifolia, Leersia oryzoides.

The Mill River, a stream about fifteen miles in length, located in Northampton and Williamsburg, Massachusetts, has been subjected since 1654 to disturbance by pollution, relocations of the channel, and impoundment for industrial purposes. Vascular plant communities in down-stream marshes possessed lower species richness and diversity and greater amounts of unoccupied substratum than those in upstream, less disturbed marshes. The invasion of the lower marshes by Marsilea quadrifolia L. during a period of heavy pollution was observed. Leersia oryzoides (L.) Sw., the only species found in all zones of all marshes, was dominant in early stages of floodplain succession. An inventory of the summer flora of more than 275 species of vascular plants within the river and its floodplain is included. Fluorescent strains of Pseudomonas were found at all sampling stations and comprise a part of the indigenous microbial flora of the stream. Pseudomonas aeruginosa (pigmented strains) were widely distributed. Coliform organisms, lacking at

the source, occurred with high densities in all downstream stations. A method of enrichment for obtaining Pseudomonas species was devised. Future studies of the vegetation and microbial flora will indicate the degree to which the stream ecosystem responds to pollution abatement.
W72-05092

HUMAN EXPOSURE TO MERCURY FROM GOOSANDER EGGS CONTAINING METHYL MERCURY,
Aland Central Hospital Mariehamn (Finland).
Peter Wahlberg, Eeva Karpanen, Kurt Henriksson, and Dag Nyman.
Acta Med Scand. 189 (3): 235-239. 1971. Map.
Identifiers: Eggs, Exposure, Finland, Fish, Goosander, Human, Mercury, Mergus-Merganser, Methyl, Woman.

A woman living in the Aland Islands in the Baltic had symptoms and signs which caused suspicion of Hg poisoning. She was found to be exposed to Hg, and the Hg was traced to goosander (Mergus merganser) eggs which she had consumed every year. Goosander eggs, 36 in all, were collected from various parts of the islands, and were found to contain between 0.3 and 3.5 mg/kg of Hg (mean 1.4 mg/kg). Between 0.5 and 5.8 mg/kg was found in the whites (mean 1.9) and between 0.2 and 1.8 mg/kg in the yolks (mean 0.7 mg/kg). The main part of the Hg (mean 78% of the total Hg) was in the form of methyl mercury. The mean weight of the eggs without shell was 71.1 g. The fish in the waters of the Aland Islands contain only negligible amounts of Hg, whereas the fish in the birds' winter quarters (the Danish sounds and southern Baltic) were contaminated with this metal. The birds are contaminated in their winter quarters and carry the Hg to their summer quarters, where contaminated eggs are consumed by the inhabitants. This is probably the 1st report of migratory birds carrying pollutants from their winter quarters and causing risk of human exposure to the pollutant in the summer quarters.--Copyright 1971, Biological Abstracts, Inc.
W72-05114

BACTERIOLOGY OF MANGANESE NODULES: V. EFFECT OF HYDROSTATIC PRESSURE ON BACTERIAL OXIDATION OF MNII AND REDUCTION OF MNO2,
Rensselaer Polytechnic Inst., Troy, N.Y.
H. L. Ehrlich.
Appl Microbiol. 21 (2): 306-310. 1971.
Identifiers: Arthrobacter, Bacillus, Bacterial, Bacteriology, Hydrostatic, Manganese, Nodules, Oxidation, Oxide, Pressure, Reduction.

It was experimentally demonstrated that 2 strains of Arthrobacter 37, one growing at 25 C and the other at 5 C, could catalyze MnII oxidation at hydrostatic pressures well in excess of the pressure encountered by the parent culture in its original habitat in the ocean (80 atm) (atmospheres). The strain growth at 5 C showed an increase in temperature optimum for manganese oxidation with increase in pressure. It was likewise experimentally shown that induced Bacillus 29 without added ferricyanide and uninduced Bacillus 29 with added ferricyanide could catalyze MnO2 reduction at hydrostatic pressures in excess of the pressure encountered by this organism in its original habitat (187 atm). The uninduced Bacillus 29, in the presence of ferricyanide, was active over a wider range of pressures (1 to 1000 atm) than the induced Bacillus 29 in the absence of ferricyanide (1 to 467 atm). At corresponding pressures, the uninduced culture was also considerably more active than the induced culture. Special techniques were developed for measuring MnII oxidizing and MnO2-reducing activity under pressure.--Copyright 1971, Biological Abstracts, Inc.
W72-05129

CLUSTER ANALYSIS OF NON-INSECT MACRO-INVERTEBRATES OF THE UPPER POTOMAC RIVER,
Kansas Univ., Lawrence. Dept. of Geography.
Roger L. Kaesler, John Cairns, Jr., and John M. Bates.
Hydrobiologia. 37 (2): 173-181. 1971. Illus.
Identifiers: Algal, Cluster, Fish, Insect, Invertebrates, Macro, Non-Insect, Potomac, River, Species, Protozoan.

A series of limnological surveys carried out from 1956 until 1965 were made in the vicinity of the Dickerson Plant of the Potomac Electric Power Company by the Limnology Department of the Academy of Natural Sciences of Philadelphia. These surveys were made at various stages of growth of the power station and at high and low water levels of the river. Cluster analyses were made of the non-insect macro-invertebrates in order to provide a rapid and explicit means of analyzing the data, particularly relationships among aggregations of species. On the basis of the cluster analysis of data on occurrence and distribution of non-insect macro-invertebrates, no changes in the environment of the Upper Potomac River can be ascribed to the operation of the Dickerson Plant of the Potomac Electric Power Company. This conclusion agrees with the other results obtained by analyses of protozoan, algal, fish, and insect species. Jaccard coefficients among aggregates of the invertebrates included in this study are generally higher than those for the other groups of organisms studied except for fish. This may be the result of high tolerance of some of the species to a wide range of environmental conditions.--Copyright 1971, Biological Abstracts, Inc.
W72-05134

PHENYLMERCURIC ACETATE: METABOLIC CONVERSION BY MICROORGANISMS,
Wisconsin Univ., Madison. Dept. of Entomology.
Fumio Matsumura, Yoshiko Gotoh, and G. Mallory Boush.
Science (Washington). 173 (3991): 49-51. Illus. 1971.
Identifiers: Acetate, Conversion, Mercuric, Metabolic, Microorganisms, Phenyl.

Phenylmercuric acetate, an organomercurial used as a fungicide and slimicide, was quickly metabolized by soil and aquatic microorganisms. A major metabolic product was diphenylmercury. A methylmercury derivative was not found among the microbial metabolic products of phenylmercuric acetate.--Copyright 1971, Biological Abstracts, Inc.
W72-05138

DISTRIBUTION OF HETEROTROPHIC BACTERIA AND THEIR POSSIBLE ROLE IN THE MINERALIZATION OF ORGANIC MATTER IN YUNO-KO, A MESOTROPHIC LAKE,
Tokyo Metropolitan Univ. (Japan).
Yasuhiko, Tezuka.
Jap J Ecol. 20 (4): 151-158. 1970. Illus. Map.
Identifiers: Bacteria, Distribution, Heterotrophic, Japan, Lake, Matter, Mesotrophic, Mineralization, Organic, Phyto, Plankton, Yuno-Ko.

Vertical distribution of heterotrophic bacteria in the water body of Lake Yuno-ko showed a clear seasonal variation; during the summer stagnation period, the number of heterotrophic bacteria was larger in the upper than in the lower layer, while during the circulation period, it was uniformly distributed. Total plankton respiration measured with concentrated plankton gave the highest value (3.11 g O2/m2/day) in Aug. and the lowest (0.47 g) in Feb. During the circulation period, total plankton respiration was uniform vertically, while during the stagnation period, it was higher in the upper layer. Respiration rate of the bacterial population in the lake water was calculated on the basis of the data on the number of bacteria and the respiratory activity of 1 bacterial cell, which was determined with separated and concentrated bacterial population. Percentage contribution of the bacterial respiration to the total plankton respiration was estimated as only 3 to 7. It is suggested that bacteria might play a minor role in the mineralization process occurring in the water body. The major agents participating in this process could be the phyto- and/or zooplankton. Organic matter loss from the lake water by the precipitation of particulate matter appeared to be small, largely attributed to plankton respiration in the warmer season and to the outflowing river in the colder season.--Copyright 1971, Biological Abstracts, Inc.
W72-05160

MICROBIOLOGICAL STUDIES ON NIGROGEN CYCLE IN AQUATIC ENVIRONMENTS: I. EFFECT OF OXYGEN TENSION ON MICROFLORA AND BALANCE OF NITROGENEOUS COMPOUNDS IN THE EXPERIMENTAL AQUARIUM.
Kyoto Univ. (Japan). Research Inst. for Food Science.
Akira, Kawai, Motohiko, Sugiyama, Ryoji Shiozaki, and Isao Sugahara.
Mem Res Inst Food Kyoto Univ. 32. 7-15. 1971. Illus.
Identifiers: Aquarium, Aquatic, Bacteria, Balance, Compounds, Cycle, Environments, Flora, Micro, Microbiological, Nitrogen, Nitrogenous, Oxygen, Tension.

Using experimental aquaria, the metabolic pattern of nitrogenous compounds and the standing crops of bacteria which are responsible for N cycle in aquatic environments were studied under different O2 supplies. In the water in which dissolved oxygen (DO) is sufficient, organic N is metabolized mostly in the form of nitrate, while the accumulation of ammonia occurs in the water with low O2 tension. This may be attributed to the fact that the lower the DO in water, the smaller the standing crop of nitrifying bacteria. No essential difference was found in sea water and freshwater aquaria.--Copyright 1971, Biological Abstracts, Inc.
W72-05164

ECOLOGICAL OBSERVATIONS ON THE ALTERATIONS IN THE LAKE BIOCENOSIS OF TOVEL LAKE (TRENTINO), (IN ITALIAN),
Alvise, Vittori.
Stud Trentini Sci Nat Sex B Biol. 46 (2): 267-281. 1969. Illus. Map. English summary.
Identifiers: Alterations, Biocenosis, Ecological, Glenodinium-Sanguineum, Italy, Lake, Tovel, Trentino.

Data collected between 1966 and 1969 indicated hydrobiological alterations of the lake affected, in particular, the alga Glenodinium sanguineum, the organism responsible for the characteristic reddening of the water of Lake Tovel.--Copyright 1971, Biological Abstracts, Inc.
W72-05165

A STUDY OF THE VARIATION OF WATER LEVEL AND MINERALIZATION OF THE GROUND WATER IN THE DANUBE DRAINAGE AREA 'BOIANU-STICLENAU' (IN RUMANIAN),
Institutul Agronomic, Bucharest (Rumania).
I. Plesa, G. Florescu, A. Oblocinschi, I. Birnaure, and M. Paunet.
Lucrari Stiint Inst Agron N Balcescu Ser A. 12: A study on the early effects of the damming of the Danube indicated no apparent deleterious effects on the mineral concentration balance of the waters and on the yield of corn in the affected area in relation to the increased water table.--Copyright 1971, Biological Abstracts, Inc.
W72-05169

STERILIZATION OF THE TESTICLES OF GUPPIES BY MEANS OF NON-LETHAL DOSES OF PARATHION (IN FRENCH),
Station Centrale de Physiolgie Animale, Jouy-en-Josas (France).
R. Billard.
Ann Hydrobiol. 1 (1): 91-99. 1970. Illus. English summary.
Identifiers: Doses, Fishery, Guppies, Hypophysectomy, Indicator, Non-Lethal, Parathion, Pesticides, Pollution, Sterilization, Testicles.

Young immature guppies and adult males are treated in dilute parathion, at doses of 0.01,0.1,1 and 10 ppm. At the 10 ppm d, fish die within a few hours. Other concentrations do not cause a high mortality rate or alter spermatogenesis if the exposure time is short (6 days). On the contrary, if the fish remains in parathion over a prolonged period (40 days), there is a marked inhibition of spermatogenesis, expressed by a decrease in the number of germinal cells which is greater, the higher the dose of parathion. Results are similar to those obtained after hypophysectomy, which indicates that parathion may play a role in the gonadotropic factors. These results confirm the necessity to define pesticide doses supportable in water, not using TLM (Median-tolerance limits) but various criteria including gametogenesis.--Copyright 1971, Biological Abstracts, Inc.
W72-05191

OBSERVATIONS ON THE PLANKTON OF THE PORT OF CIVITAVECCHIA, (IN ITALIAN),
Rome Univ. (Italy). Instituto di Zoologia.
Dino Levi.
Pubbl Sta Zool Napoli. 37 (3): 421-433. 1969. Illus. English summary.
Identifiers: Civitavecchia, Copepod, Italy, Plankton, Pollution, Port.

A preliminary investigation was made on both structure of the zooplankton population and primary productivity of the port of Civitavecchia during Sept. 1967-Aug. 1968. An autogenic copepod community is emphasized and the values of primary productivity are constantly low. Embayment state and pollution seem to influence the observed data.--Copyright 1971, Biological Abstracts, Inc.
W72-05196

THERMAL ADDITION STUDIES OF THE CRYSTAL RIVER STREAM ELECTRIC STATION,
Fla. Dep. Natl. Res. Mar. Res. Lab., St. Petersburg.
Churchill B. Grimes.
Fla Dep Natur Resour Mar Res Lab Prof Pap Ser. 11: 1-53. 1971. Illus. Map.
Identifiers: Bairdiella-Chrysura, Crystal, Diversity, Electric, Florida, Index, Lagodon-Rhomboides, Opsanus-Beta, Orthopristis-Chrysopterus, Oyster, River, Station, Steam, Thermal.

A field investigation was made throughout 1969 to determine the ecological effects of hot water discharge by a steam electric generating plant in Crystal River, Florida. Temperature monitoring revealed the occasional existence of inverse thermal stratification in the discharge area apparently due to the greater salinity of intake waters. Trawl sampling disclosed that only shallow inshore areas near the discharge were thermally affected. Abundance of fishes at all shallow stations was greatest during spring and fall, but decreased in summer. In winter these stations were nearly barren. Comparison of data from affected vs. nonaffected trawl stations revealed greater abundance of fishes during late fall and early winter at affected stations but no large differences during other seasons. (Non-affected station abundance was a maximum of 60 in spring, a minimum of 20 in summer, a maximum of 85 in fall, and 4 in Dec; affected station abundance was a maximum of 59 in spring, a minimum of 21 in summer, a maximum of 138 in fall, and 65 in Dec.). Shallow affected stations also possessed the greatest species abundance during late fall and early winter. Non-affected station species abundance was a maximum of 8 in fall and 2 in Dec; affected station species abundance was a maximum of 10 in fall and 10 in Dec.). Winter warm temperatures, surface and bottom, at non-affected shallow stations were 14.3-14.6 C (57.7-58.3 F) and 14.0-15.8 (57.2-58.6 F) as compared to 14.3-15.5 C (57.7-60.4 F) and 14.3-16.5 C (57.7-62.2 F) surface and bottom at shallow affected stations. The linear regression of the annual growth (mean standard length vs. time) of age 0 Bairdiella chrysura (Lacepede), Lagodon rhomboides (Linnaeus), and Orthopristis chrysopterus (Linnaeus) collected at affected and nonaffected stations was calculated. Statistical comparison of the coefficients of regression (affected vs. nonaffected) revealed no significant differences in annual growth increments within any of the 3 species. Standard length frequency plots of the same fishes revealed no differences in spawning time or age composition of the demes from affected vs. nonaffected areas. Comparison of the relative abundance of O. chrysopterus, B. chrysura, L. rhomboides, and Opsanus beta (Goode and Bean) from affected and nonaffected stations revealed no significant changes in relative species abundance. The diversity index (S-1)/lnN was used to compare species diversity of fishes at stations of increasing distance from the point of discharge. Slight shifts in diversity toward the discharge in winter and away in summer were noted. Trace metals analysis of oyster meats from the discharge and intake canals revealed substantial increases of Cu and Zn in discharge canal oysters. These increases are believed related to increased ion presence in discharge waters as well as increased water temperature.--Copyright 1971, Biological Abstracts, Inc.
W72-05201

AN ANALYSIS OF THE FAUNA OF HUMIC LAKES WITH RESPECT TO THEIR TYPOLOGY, (IN RUSSIAN),
Gosudarstvennyi Nauchno-Issledvatelskii Institut Ozernogo i Rechnogo Rybnogo Khozyaistva, Leningrad (USSR).
A. A. Salazkin.
Zool Zh. 50 (2): 173-183. 1971. English summary.
Identifiers: Fauna, Fish, Humic, Invertebrates, Lakes, pH, Typology.

The classification of lakes by trophic types is based on the ratio of O2 content in winter to its content in summer. The humification of water bodies exerts no marked influence on the fauna. The differences observed are insignificant and unreliable. The use of this index as a typological criterion is not practical. The fauna composition is, to a great extent, determined by the environmental pH. Since pH value is low, the species composition of invertebrates and fishes is poor. Nine types of lakes are proposed: oligotrophic neutral-alkaline; oligo-, meso- and polyacidic; mesotrophic neutral-alkaline, oligo- and mesoacidic; eutrophic neutral-alkaline and oligoacidic.--Copyright 1971, Biological Abstracts, Inc.
W72-05206

IANULA: AN ACCOUNT OF THE HISTORY AND DEVELOPMENT OF THE LAGO DI MONTEROSI, LATIUM, ITALY: VIII. THE FOSSIL FLORA AND FAUNA (OTHER THAN SILICEOUS FOSSILS, POLLEN, AND CHIRONOMID HEAD CAPSULES),
Academy of Natural Sciences of Philadelphia, Pa.
Clyde E. Goulden.
Trans Amer Phil Soc. 60 (Part 4): 102-111. 1970. Illus.
Identifiers: Bosmina-Longirostris, Capsules, Chironomid, Development, Di, Fauna, Flora, Fossil, Fossils, Head, History, Ianula, Italy, Lago, Latium, Leydigia-Acanthocercoides, Leydigia-Leydigi, Monterosi, Pediastrum-Simplex, Pollen, Siliceous.

The early biotic history of Lago di Monterosi was characterized by an initial development of an unproductive littoral community followed by a very long interval, approximately 22,000 yr, of extremely low productivity when most plant and animal microfossils were rare or absent in the sediment. This period ended abruptly as a result of cultural disturbances (some 2300 to 2500 yr ago) that initiated the development of large populations of blue-green algae, chydorid Cladocera, and midges. This highly eutrophic environment was relatively short-termed and was replaced by a less eutrophic phase, dominated by Pediastrum and the cladoceran; Bosmina longirostris. Populations representing the latter biota gradually declined and there again ensued a rather long interval in the sediment of relatively low microfossil populations. A 2nd major cultural disturbance began sometime in the 10th or 11th century, causing a renewed expansion of the biota with P. simplex, B. longirostris, and the 2 limnicole chydorids, Leydigia leydigi and L. acanthocercoides, as the dominant forms. Although the intensity of cultural disturbances later decreased, as seen in the smaller microfossil populations above 23 cm, the same organisms continued to dominate the biota. However, in recent years the lake has acquired a very different fauna, not seen in the sediment, that may have developed as a result of a sharp fall in water level from 8 to 5 m. (See also W72-05208 and W72-05209)--Copyright 1971, Biological Abstracts, Inc.
W72-05207

IANULA: AN ACCOUNT OF THE HISTORY AND DEVELOPMENT OF THE LAGO DI MONTEROSI, LATIUM, ITALY: IV. PRESENT ECOLOGICAL CONDITIONS IN THE LAKE,
Instituto di Zoologia. Rome Univ. (Italy).
Emilia Stella, and Fiorenza Marfaritora.
Trans Amer Phil Soc. 60 (Part 4): 17-25. 1970. Illus.
Identifiers: Asplanchna-Priodonta, Ceratium, Chaoborus, Daphnia-Rosea, Development, Ecological, Eudiaptomus-Vulgaris, Fish, History, Ianula, Italy, Keratella-Quadrata, Lago-Di-Monterosi, Lake, Latium, Microcystis, Pedalia-Mira, Volvox.

The observations carried out monthly from winter, 1964, to spring, 1965, outline a tentative picture of the present characteristics of the populations. Since the basin has a pond-lake character, it gives rise to a quantitatively abundant zooplankton which is poor from the qualitative point of view as far as Entomostraca are concerned. The heleoplanktonic species prevail over the eulimnetic ones. The ecological situation is unstable and reveals remarkable temperature range, variations of the lake levels and chemical composition of the waters. However, owing to the lake's isolation, a rather good equilibrium is kept in the lake between nutrient substances and phytoplankton-zooplankton. The benthic biocoenosis shows a structure depending on both the nature of the substrata and the shallowness of the basin; the organisms of the vegetation and of the bottom sediments prevail, while those of gravelly and stony bottoms are lacking. The structure of the populations allows comment on the trophic condition of the lake. The phytoplankton presents a dominant association of Dinophycaeae, Chlorophyceae, Myxophycaeae, with water blooms of Microcystis in autumn, of Volvox in spring, and of Ceratium and filamentous algae in summer. Diatoms are scarce. The zooplankton is represented by Daphnia rosea, Eudiaptomus vulgaris, Keratella quadrata, Asplanchna priodonta and Pedalia mira. On the bottom Chaoborus is present. The annual production of fish is considerable, almost half a quintal per hectare, and does not undergo any deterioration because fishing is private. Such data, according to recent classifications of pond typology (Wurtz, 1958), show a mesotrophic condition with a tendency towards eutrophy. The O2 values so far detected would confirm such an assumption; it would be supported by a more careful test of both the physiochemical composition of the waters and the nature of the bottom sediments. These latter,

in fact, are probably the sole elements of stability in a pond-lake habitat such as that of Lago di Monterosi. (See also W72-05207 and W72-05209)--Copyright 1971, Biological Abstracts, Inc.
W72-05208

IANULA: AN ACCOUNT OF THE HISTORY AND DEVELOPMENT OF THE LAGO DI MONTEROSI, LATIUM, ITALY: XIII. THE HISTORY OF THE LAKE: A SYNTHESIS,
Yale Univ., New Haven, Conn. Dept. of Biology.
G. E. Hutchinson, and Ursula Cowgill.
Trans Amer Phil Soc. 60 (Part 4): 163-170. 1970. Illus.
Identifiers: Development, History, Ianula, Italy, Lago-Di-Monterosi, Lake, Latium, Synthesis.

It will be apparent that the history of Lago di Monterosi gives almost no support to any theory of inevitable development of a lake from an oligotrophic to eutrophic condition as is implied for instance in the writings of Thienemann (1925) and as has been suggested in a more detailed form by Hutchinson and Wollack (1940). Only at the top of B3 (stratigraphic period) and then at a time when some human disturbance cannot be ruled out, is there any hint of an inevitable progression towards a more productive state. Apart from this very doubtful qualification, all the changes in the lake seem to involve determinant changes in the lake basin. Whether this would be true of a deeper lake in comparable circumstances remains to be investigated. (See also W72-05207 and W72-05208)--Copyright 1971, Biological Abstracts, Inc.
W72-05209

LIMNOLOGICAL STUDIES IN BELGIUM: VI. THE MEANDERS OF THE DURME RIVER AT HAMME (EAST FLANDERS PROVINCE),
Institut Royal des Sciences Naturelles de Belgique, Brussels.
For primary bibliographic entry see Field 05A.
W72-05210

LIMNOLOGICAL STUDIES IN BELGIUM: VII. TWO PONDS AT NOTMEIR (ANVERS PROVINCE). A. ENVIRONMENTAL STUDY,
Institut Royal des Sciences Naturelles de Belgique, Brussels.
L. Van Meel.
Bull Inst Roy Sci Natur Belg. 47 (11): 1-76. 1971. Illus.
Identifiers: Algae, Anvers, Belgium, Chlorophyll, Environmental, Limnological, Minerals, Notmeir, Phyto, Plankton, Ponds, Province, Zoo.

In this first part of the study of 2 ponds at Notmeir, covering a 1-yr period (it was not possible to study a complete cycle) with weekly observations, water temperature, pH, alkalinity, dissolves O2 and its saturation, ammonia, nitrates, phosphates, silicates, carbohydrates, organic matter (oxidizability) and chlorophylls a, b and c were studied. In order to localize biological decalcification, the alkaline and Ca reserve was determined for crude and filtered water. The N cycle, with its variations during the year, was also studied. A relationship was found between the various algae orders and the concentrations of the 3 chlorophylls a, b, and c, considered separately. The carbohydrate and dissolved organic matter concentrations were also studied, and a relationship was found between phytoplankton composition and periodicity and variations in these substances, considered as metabolites of the algae and as the results of the hydrolysis of plant refuse. In each season, a complete analysis of the ionic balance, as well as the determinations mentioned (chlorides, sulfates, Mg, Na and K) was made. All of the elements determined show maximum and minimum concentrations which correspond more or less among themselves and the presence or absence of variable amounts of phytoplankton. The influence of zooplankton was considered in toto. The amount of nutritive substances showed these waters have a high degree of eutrophication. (See also W72-05215)--Copyright 1971, Biological Abstracts, Inc.
W72-05214

LIMNOLOGICAL STUDIES IN BELGIUM: VII. TWO PONDS AT NOTMEIR (ANVERS PROVINCE): B. PHYTOPLANKTONIC CONSIDERATIONS. C. CONCLUSIONS,
Institut Royal des Sciences Naturelles de Belgique, Brussels.
L. Van Meel.
Bull Inst Roy Sci Natur Belg. 47 (12): 1-48. 1971. Illus.
Identifiers: Anvers, B, Bacillariophyta, Belgium, C, Chlorophyll, Chlorophyta, Chrysophyta, Conclusions, Cyanophyta, Limnological, Minerals, Notmeir, Phyto, Planktonic, Ponds, Province, Species.

In this 2nd part of the study on 2 ponds at Notmeir, the general characteristics of the phytoplankton, comprising 78 spp. were studied. Bacillariophyceae and Chlorophyta were preponderant in the composition of the population. In Pond A (74 spp.) the local flora was made up mainly of Chrysophyta (Dinobryon), Bacillariophyceae (Asterionella) and Chlorophyta (Scenedesmus). In Pond B (29 spp.), the local flora was composed mainly of Cyanophyta, Bacillarioophceae and Chlorophyta. In Pond A, Centronella reichelti, a diatom, was also found, probably for the 1st time in Belgium. The percentage composition of the phytoplankton and its distribution throughout the year, the periodicity of the planktonic species, their occurrence per month, the relative rarety of the species, and their occurrence per season, were also studied. The dominant species include: Microcystis flos-aquae, Dinobryon sertularia, Synedra acus var. angustissima, Asterionella formosa, Peridinium cinctum, Ceratium hirundinella, Pediastrum boryanum, Pediastrum simplex, Coelastrum microporum, Scenedesmus quadricauda, Straurastrum paradoxum. Certain relationships between ecological factors and the phytoplankton were demonstrated, especially with regard to the mineral and organic substances dissolved in the water and the composition and periodicity of the phytoplankton species. The carbohydrates and the probable effects of inhibiting and growth-inducing substances and the extra-cellular substances excreted by the algae were also studied. For both ponds, the phytoplankton production was compared to the concentrations in N, P, chlorophyll and carbohydrates. A relationship was also found between the various algae orders and families and the concentrations of 3 chlorophylls a, b and d, considered separately. (See also W72-05214)--Copyright 1971, Biological Abstracts, Inc.
W72-05215

NUTRIENT REGENERATION FROM DEAD FRESHWATER PLANKTON,
Aligarh Muslim Univ. (India). Dept. of Zoology.
Jamil A. Khan, and A. Qayyum Siddiqui.
Indian J Exp Biol. 9 (1): 57-59. 1971.
Identifiers: Carbonaceous, Constituents, Dead, Fresh, Nutrient, Plankton, Regeneration.

Decomposition of dead freshwater plankton in anaerobic conditions was studied. There was no evidence of any lag phase in the ammonification of nitrogenous fractions. Nitrifying activity was not observed. Only nitrite was formed and its concentration increased gradually. Carbonaceous constituents in dead plankton were quickly decomposed. Orthophosphate and silicate were remineralized slowly. No relationship between the regenerating nutrients was discernible.--Copyright 1971, Biological Abstracts, Inc.
W72-05219

CHARACTERISTICS OF THE EPIDEMIOLOGY OF DIPHYLLOBOTHRIASIS IN SOME LAKE AREAS IN BURYATIA, (IN RUSSIAN),
Institute of Medical Parasitology and Tropical Medicine, Moscow (USSR).
A. S. Artamoshin.
Med Parasitol Parazit Bolezn. 40 (2): 145-150. 1971. English summary.
Identifiers: Burbot, Buryatia, Diphyllobothriasis, Diphyllobothrium-Latum, Epidemiology, Human, Lake, Perch, Pike, USSR.

In 1968-1969, a foci of diphyllobothriasis were investigated. In the Tsipinsky lakes pikes, burbots and perches were found to be infested with plerocercoids of Diphyllobothrium latum. In the Baunt lake, 12% of pikes were infested; in the Busani lake, 30%. In the same lake, 31-38% of sigs were infested with type E plerocercoids. Among 98 people examined in 1968, 13 had diphyllobothriasis. In the area of the Eravinsky lakes, D. latum occurs. In Sosnovsky lake, 5% of pikes are infested with plerocercoids of D. latum; in Great Eravna lake, 23%. Considering the comparatively low infestation rate of fish with plerocercoids of D. latum in the human population the rate of diphyllobothriasis is relatively high in this region.--Copyright 1971, Biological Abstracts, Inc.
W72-05225

A HYGIENIC EVALUATION OF THE NEW PLASTICIZER TOLYLNAPHTHYLMETHANE,
O. I. Voloshchenko, and V. N. Chekal'.
Gig Naselennykh Mest Resp Mezhved Sb. 9. 160-162. 1970.
Identifiers: Contamination, Heat, Hygienic, Mammal, Methane, Naphthyl, New, Plasticizer, Tolyl, Toxicity.

The new and promising polyvinylchloride plasticizer, tolylnaphthylmethane (I) may, when it enters sewage water, contaminate inland waters of water supplies. Its organoleptic properties and the general sanitary conditions of inland waters in the presence of I and the toxic properties of I given orally to warm-blooded animals were studied. At a concentration of 0.96 mg/l, I gave the water an odor and taste rated at 1 arbitrary degree but when the water temperature was raised to 60 C, the threshold went up; at concentrations of 0.1, 1.0, 10.0, and 100.0 ml/l, I had no effect on the natural self-cleaning processes of inland waters. I was of low toxicity for warm-blooded animals. The content of I in water should not exceed 0.96 mg/l.--Copyright 1971, Biological Abstracts, Inc.
W72-05236

ESTABLISHING HYGIENIC STANDARDS FOR THE NEW COMBINED ANTI-MONOCOT HERBICIDE 50/30 CELATOX IN INLAND WATERS,
M. I. Mgzhegotskii, and V. Z. Martynyuk.
Gig Naselennykh Mest Resp Mezhved Sb. 9. p72-76. 1970.
Identifiers: Celatox, Fish, Herbicide, Hygienic, Inaldn, Monocot, New, Standards, Toxicity.

A sanitary-toxicological characterization is given of the anti-monocot herbicide celatox (I) in acute and chronic experiments on 498 animals and according to the organoleptic properties of water and the sanitary condition of inland waters. The variables of toxicity were changes in the CNS, liver function, kidneys, and peripheral blood, and also the effect of (I) on fish and their progeny. (I) is classified as having low toxicity. The picture of poisoning is characterized by changes in the CNS, liver function, and peripheral blood. Note is made of the general resorptive and locally irritating action of (I) on the skin and mucous surface of the eye, and of the danger of the herbicide for fish and its effect on their progeny. (I) had some effect on the organoleptic and chemical properties of water. The recommended maximum allowable concentration of (I) in inland waters is 0.5 mg/l.--Copyright 1971, Biological Abstracts, Inc.
W72-05248

EFFECT OF 2 MOLLUSCICIDES (BAYLUSCIDE AND FRESCON) ON FRESH-WATER MUSSELS: DREISSENA POLYMORPHA PALLAS,
Facultes Catholiques de Lille (France). Lab. of Marine Biology.
Henri Hoestlandt.
C R Hebd Seances Acad Sci Ser D Sci Natur (Paris). 272 (14): 1912-1914. 1971. Illus.

Identifiers: Bayluscide, Bucephalus-Polymorphus, Dreissena-Polymorpha, Fish, Frescon, Fresh, Human, Molluscicides, Mussels, Toxicity, Vector.

D. polymorpha invades water pipelines of towns and factories, greatly diminishing the water flow; it is also the intermediate host for the trematode Bucephalus polymorphus, which causes a high death rate among freshwater fish. Among the many molluscicides tested, 2 had a very toxic effect: Frescon (WL 8008) (LD50 = 0.037 x 10-6) and Bayluscide (Niclosamide) (LD50 = 0.037 x 10-6). Considering the life cycle of mussels, it is easy to prevent its installation in water pipe systems by using, on 2 days of the year (autumn and spring), Bayluscide doses of 0.1 to 0.3 x 10-6, according to the condition of the water (pH, suspended material). This is considered to be of no appreciable danger to humans.--Copyright 1971, Biological Abstracts, Inc.
W72-05249

EXPERIMENTAL INVESTIGATIONS INTO THE INFLUENCE OF SOME ORGANIC--PHOSPHORIC INSECTICIDES ON THE OXYGEN CONTENT OF WATER, (IN GERMAN),
Ingrid Ruckert, and Naum W. Ghelberg.
Deut Gewaesserk Mitt. 15 (1): 16-23. 1971. Illus. English summary.
Identifiers: Insecticides, Organic, Oxygen, Phosphoric, Pollution, Toxicity.

The final and total effect of some organic-phosphoric emulsified insecticides of the types Bromophos (B), Ronnel (R), Malathion (M), Dimethoat (D), Ethion (E), and of the emulsifier e40 in conjunction with which they are used, on dissolved oxygen was examined according to conventional methods (BOD (Biochemical Oxygen Demand)1-21 and 'immediate' O2 consumption). The influence on the two basic processes involved in the self-purification of waters (production and consumption of O2) was investigated with the aid of the 'A-Z' test according to Knopp. Each of the 4 insecticides has a different influence on the 'immediate' and 'bio-chemical' O2 consumption of the water to which they are added. The highest values for the 'immediate' and 'bio-chemical' O2 consumption were found with D and M, lower values with E, and the lowest with R, B and e40. The 5 insecticides show differences in toxicity in response to the 2 basic bio-chemical reactions (production and consumption of oxygen), as far as type, intensity and duration of their influence is concerned. Immediately after the pollution of the water, the insecticides B and R showed the highest toxicity with both basic bio-chemical reactions, followed by E with lower toxicity, and D and M with the lowest. Due to their instability in hydrous solutions, the toxicity of the insecticides changes with time during the complicated processes of the water's O2 balance. M is the most stable of the 5, followed by D, E, B and R. The examined insecticides differ in their reaction to the biological composition of the water.--Copyright 1971, Biological Abstracts, Inc.
W72-05258

5D. Waste Treatment Processes

THE GROWTH OF PORES IN GRAPHITIZED CARBON REACTED WITH CARBON DIOXIDE,
Colorado Univ., Boulder. Dept. of Chemical Engineering.
M. Kalback, F. Brown, and E. West.
Carbon, Vol 8, p 117-124, 1970. 1 fig, 4 tab, 28 ref. EPA, WQO Grant No. 17020 DDC.

Descriptors: *Pores, *Carbon, Oxidation, Chemical reactions, Diffusion, Physical properties, Porosity.
Identifiers: *Graphite, Porous structure.

Cylinders of a very pure graphitized porous carbon were reacted to 10, 20 and 30 per cent burnoff at 1030C. Based upon pore size distributions obtained from the unburned carbon and from radial sections of the cylinders at each percentage burnoff, the major portion of early pore development apparently occurred by preferential burning of single crystallites of carbon. This yielded pores of approximately the same size as the original carbon crystallites. These pores reached a maximum volume, whereupon further development in this range of pore sizes ceased. Burning away of the walls of the larger pores then became the major portion of the reaction. (EPA abstract)
W72-04704

COLIFORM AEROSOLS EMITTED BY SEWAGE TREATMENT PLANTS,
Deseret Test Center, Fort Douglas, Utah.
A. P. Adams, and J. C. Spendlove.
Science, Vol 169, No 3951, p 1218-1220, September 18, 1970. 1 fig, 1 tab, 9 ref.

Descriptors: *Aerosols, *E. coli, *Bioindicators, *Sewage treatment, Sampling, Cultures, Solar radiation, HUMIDITY, Temperature, Path of pollutants, Light, Wind, *Air pollution.
Identifiers: Anderson samplers, Agars, Human feces, Feces.

The aerosols emitted by two trickling-filter sewage-treatment plants were studied for emission of coliforms. Anderson samplers were used to collect the aerosols near and up to 0.8 mile downwind of the plants. Collections were made both during the day and at night. Three different mediums were used for culturing samples: Casitone agar for collection and growth of general microbials, and Endo's medium, and eosin methylene blue for selective growth of coliforms. Substantial numbers of coliforms were emitted. The concentration of coliforms near the source was most effected by the size of the source and the wind velocity. Further downwind, high-wind velocities, high relative humidity, darkness, and low temperatures gave the greatest recovery concentrations. Solar radiation reduced recovery. (Mortland-Battelle)
W72-04711

STRATEGIES FOR CONTROL OF MAN-MADE EUTROPHICATION,
Committee on Public Works (U.S. Senate).
R. D. Grundy.
Environmental Science and Technology, Vol 5, No 12, p 1184-1190, December 1971. 6 fig, 5 ref.

Descriptors: *Eutrophication, *Phosphates, *Water pollution control, *Waste water treatment, *Cost-benefit analysis, Detergents, Phosphorus, Nitrogen, Nutrients, Sewage, Water temperature, Light penetration, Carbon, Lake Erie, Runoff, Erosion, Chlorella, Sodium compounds, Alkalinity, Mining, Biochemical oxygen demand, Economics, Algae, Agricultural chemicals, Legislation.
Identifiers: Potomac River, Alafia River, Chlorella pyrenoidosa, Sodium silicate, Sodium metasilicate, Lake Washington, Nitrilotriacetate, Human feces.

Sources of phosphates, and other nutrients in the aquatic ecosystem include not only detergents, but also sewage, erosion, and agricultural runoff. On a national basis, detergents provide 30 to 40 percent of all the phosphorus entering the aquatic environment. However, this figure is shown to vary on a regional basis. Because there are many other sources of phosphates, their control in detergents is not in itself a sufficient strategy to control eutrophication. Also, any regulation on phosphates in detergents should not be undertaken without careful consideration of the public health and environmental implications of alternative formulations. Valid control strategies should include advanced waste water treatments, diversion, dilution, and land disposal. Waste water treatment using chemical precipitation processes, not only removes phosphorus but also facilitates the removal of BOD, toxicants, and other nutrients. Economic considerations show that 90 percent of municipal waste water could be treated for phosphorus removal at less cost to the consumer than the increased product costs for detergent phosphate substitutes. It is also significant that treatment reduces total phosphate levels while product controls affect detergent phosphate alone. (Mortland-Battelle)
W72-04734

AN INTERSECTORAL PROGRAMMING MODEL FOR THE MANAGEMENT OF THE WASTE WATER ECONOMY OF THE SAN FRANCISCO BAY REGION,
Technion-Israel Inst. of Tech., Haifa. School of Engineering.
For primary bibliographic entry see Field 05B.
W72-04780

OPERATIONAL STABILITY OF THE EXTENDED AERATION PROCESS,
Oklahoma State Univ., Stillwater. Dept. of Civil Engineering.
A. F. Gaudy, Jr.
Available from the National Technical Information Service, Springfield, Va. 22151, as PB-206 909, $3.00 in paper copy, $0.95 in microfiche. Oklahoma Water Resources Research Institute, Stillwater, Completion Report 1971. 212 p, 61 fig, 3 tab, 39 ref, 4 append. OWRR A-017-OKLA (1).

Descriptors: *Waste water treatment, *Aeration, *Oxidation, *Sludge treatment, *Activated sludge, *Sludge digestion, Pilot plants, Metabolism, Biomass, Aerobic treatment, Hydrolysis, Biological treatment, Biodegradation, *Digestion.
Identifiers: Total oxidation, Extended aeration, *Aerobic digestion, Autodigestion, Chemical hydrolysis, Hydrolyzed sludge.

This project was initiated to determine if an activated sludge process could operate with total cell recycle over an extended period of time. Previous researchers had concluded that such a process (the extended aeration or toal oxidation activated sludge process) could not function and that cell or sludge wastage would be necessary. Some had concluded on the basis of short term studies that the process was theoretically impossible and that, because of the biological production of an inert organic fraction of cell mass, the sludge concentration would continually build up. The inert fraction would thus become an ever-increasing fraction of the activated sludge and the system would eventually undergo metabolic failure, i.e., lose the ability to purify waste waters. It was felt that these conclusions had never been subjected to complete testing; also, that if the system were to fail, there was need for engineering data to estimate how long such a system could be successfully operated before failure. Accordingly, a laboratory scale pilot plant activated sludge process was operated in which positive control of sludge retention in the system was obtained by passing all contents through a centrifuge and returning the separated biomass to the aeration chamber. Thus no sludge was wasted (purposely or inadvertently). This system was operated for three years and there was no evidence of metabolic failure; excellent purification was obtained. The sludge concentration did not continually build up, but underwent periods of accumulation and de-accumulation. The periods of de-accumulation corresponded to cycles of metabolism wherein autodigestion of the biomass exceeded new growth due to metabolism of the inflowing waste. At times the sludge was observed to build up to rather high concentrations, and it was reasoned that the autodigestion might be helped or controlled by an engineering modification of the process in which a portion of the sludge could be withdrawn and subjected to chemical hydrolysis. This concept (the 'hydrolytic assist') was tested, and it was found that the hydrolyzed sludge was a readily available substrate for the remaining (unhydrolyzed) sludge. These findings (including a flow diagram for the process) were published. Also, some laboratory pilot plant research has been accomplished which indicates that the new process holds considerable promise.

W72-04784

KINETICS OF ALGAL SYSTEMS IN WASTE TREATMENT--AMMONIA-NITROGEN AS A GROWTHLIMITING FACTOR AND OTHER PERTINENT TOPICS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
M. Sobsey, J. E. Harrison, H. Gee, G. Shelet, and J. C. Goldman.
Available from the National Technical Information Service as PB-206 811, $3.00 in paper copy, $0.95 in microfiche. Final Report, Part II, September 1970, 156 p. 45 fig, 11 tab, 102 ref. FWQA Program 17010 DZQ 09/70.

Descriptors: *Algae, *Kinetics, *Nitrogen, *Nutrient requirements, Ammonia, *Growth rates, *Waste assimilative capacity, Oxidation, Dissolved oxygen, Hydrogen ion concentration, Design criteria, Mathematical models, *Bioassay, *Waste dilution, Lagoons, *Waste water treatment, Algal control, Eutrophication, Model studies, Mathematical models.
Identifiers: *Ostracods, Predator-prey relationships, *Ammonia-nitrogen, *Growth reactors, Algal ponds, Algal growth rates, *Potamocypris.

4 SMALL OUTDOOR REACTORS, A PREDATOR INFESTED OUTDOOR POND, AND NUMEROUS INDOOR SYSTEMS WERE DESIGNED, CONSTRUCTED AND OPERATED TO PROVIDE DATA DESCRIBING THE KINETICS ASPECTS OF ALGAL SYSTEMS USED AS WASTEWATER TREATMENT SCHEMES. The studies included determinations of: (1) the kinetics of ammonia-nitrogen as a growth limiting factor; (2) the effect of nutrients in wastewater effluents on algal growth; (3) suggested designs for both indoor and outdoor growth reactors; and (4) predator-prey relationships in outdoor algal systems. Specific growth rate data for nitrogen were quite consistent, allowing the use of the maximum specific net growth rate as an extremely reliable parameter of system operation. Parameters KA, KS, and SN all directly related to the maximum specific net growth rate, were shown to be useful both in mathematical interpretation of system kinetics and in determining to what percent of capacity an algal system is operating. Other studies demonstrated that permissible dilution ratios for waste water discharges into receiving waters can be formulated empirically. Design and operational information of various systems is presented, as well as preliminary bioassay results on the microbial populations of algal ponds. (Lowry-Texas)
W72-04787

KINETICS OF ALGAL SYSTEMS IN WASTE TREATMENT--PHOSPHORUS AS A GROWTH LIMITING FACTOR,
California Univ., Berkeley. Sanitary Engineering Research Lab.
Mario D. Zabat, William J. Oswald, Clarence G. Golueke, and Henry Gee.
Available from the National Technical Information Service as PB-206 810, $3.00 in paper copy, $0.95 in microfiche. Final Report Part I, September 1970, 210 p. 57 fig, 15 tab, 210 ref. FWQA Program 17010 DZQ 09/70.

Descriptors: *Algae, *Growth rates, *Kinetics, *Phosphorus, *Nutrient requirements, Temperature, Hydrogen ion concentration, Efficiencies, Water quality control, Eutrophication, Algal control, *Chlorella, *Waste water treatment.
Identifiers: *Chemostatic continuous cultures, Maximum specific growth rate, Saturation constant, Dilution, Chlorella pyrenoidosa, Monod growth model, Algal growth rates.

The kinetics and characteristics of phosphate-limited algal cultures were studied on a laboratory scale in order to: (1) evaluate kinetic parameters of algal growth in relation to phosphorus concentration; (2) derive an expression describing the growth rate-limiting nutrient relationship; and (3) determine desirable or optimum design and operating parameters for effective phosphorus removal by algal systems. Phosphorus limiting algal growth was described by the Monod growth model for specific growth rate. Maximum specific growth rate for the algae tested was 4.19/day, and all growth characteristics were significantly affected by variations in pH and temperature of the culture. Removals of moderate concentrations of phosphorus (less than or equal to 7 mg/l as P) in excess of 85% can be accomplished by continuous algal cultures. (Lowry-Texas)
W72-04788

KINETICS OF ALGAL SYSTEMS IN WASTE TREATMENT FIELD STUDIES,
California Univ., Berkeley. Sanitary Engineering Research Lab.
Aaron Meron, William J. Oswald, and Henry Gee.
Available from the National Technical Information Service as PB-206 812, $6.00 in paper copy, $0.95 in microfiche. Final Report Part III, May 1971, 334 p. 46 fig, 44 tab, 122 ref. FWQA Program 17010 DZQ 05/71.

Descriptors: *Algae, *Kinetics, *Waste water treatment, *Nutrient requirements, Temperature, *Nitrogen, *Phosphates, Anaerobic conditions, Aerobic conditions, Metabolism, Sludge, Biochemical oxygen demand, Chemical oxygen demand, Carbon dioxide, Linings, Dissolved oxygen, Light intensity, Design criteria, *Oxidation lagoons, Sewage treatment, Algal control, Biological treatment, *Growth rates.
Identifiers: Algal growth rates.

Three domestic sewage stabilization pond systems were studied to evalute the relationship between design criteria and performance criteria for pond systems in accomplishing specific waste treatment steps. System 1 consisted of a lined high-rate pond following sedimentation, system 2 was comprised of conventional secondary waste treatment followed by a pond system, and system 3 consisted solely of several deep ponds in series. Study results indicated that system 3, consisting of an anerobic pond, and unlined high-rate pond, and deep high-rate polishing pond, was effective in both BOD and nutrient removals, with mean annual removals of 97.3%, 93.2%, 91.6%, and 64.5% for BOD, COD, total nitrogen, and phosphate. Results confirmed that pond functioning is determined by position with respect to other ponds and unit processes, as well as their individual design characteristics. Other study results demonstrated that: (1) efficient N and P removal depends upon carbon availability; (2) high-rate ponds develop a sludge-slime bottom layer which prevents erosion; (3) proper nutrient balance, as measured by C:N and C:P is essential for effective algal growth and nutrient removal; (4) deep anaerobic ponds should be operated as an aerobic layer above an anaerobic layer; and (5) nutrient balance as well as pH can be adjusted in high rate ponds by CO2 addition. (Lowry-Texas)
W72-04789

BIOLOGICAL TREATMENT OF CHLOROPHENOLIC WASTES.
Jacksonville, Ark.

Copy available from GPO Sup Doc, $1.50; microfiche from NTIS as PB-206 813, $0.95. Environmental Protection Agency-Water Quality Office, Water Pollution Control Research Series, June 1971, 177p, 16 fig, 30 tab, 6 ref, 4 append. EPA Program 12130 EGK 06/71.

Descriptors: *Biodegradation, *Phenols, *Toxicity, *Biological treatment, Inhibition, *Herbicides, *Oxidation lagoons, Aeration, Industrial wastes, Taste, Odor, Efficiencies, Municipal wastes, *Waste water treatment, Arkansas, Treatment facilities.
Identifiers: *Chlorophenols, *Jacksonville (Ark), *Combined treatment.

Biological degradation of a complex waste associated with the manufacture of herbicides, specifically 2,4-D, 2,4,5-T, and 2,4,5-TP acids, was accomplished under actual field conditions. A completely stirred aeration lagoon was installed between an existing conventional sewage treatment plant and existing stabilization lagoons to avoid hydraulic overloading of the former and reduce the BOD loading to the latter. Joint treatment of the herbicide waste and diluting municipal wastes was accomplished biologically, demonstrating that pilot plant studies related to such wastes reported in other literature are valid. Following construction and operation of the joint treatment system, complaints regarding taste and odor in fish and of the receiving waters have not recurred, although analytical data indicated a level of phenolics somewhat above the threshold values reported in the literature. The biological information gathered in this study indicates that conditions prevailing in the joint treatment system do not differ in any significant way from those to be expected in a smilar system that does not receive complex chlorophenolic wastes combined with the normal sewage. In vitro experiments with individual chlorophenols and the related chlorophenoxy acids diluted with aeration lagoon effluent indicated that these substances are rapidly decomposed when sufficient biological populations have been established. (Lowry-Texas)
W72-04825

DEMONSTRATION OF ROTARY SCREENING FOR COMBINED SEWER OVERFLOWS.
Portland Dept. of Public Works, Oreg. Bureau of Sanitary Engineering.

Copy available from GPO Sup Doc, $0.65; microfiche from NTIS as PB-206 814, $0.95. Environmental Protection Agency-Research and Monitoring, Water Pollution Control Research Series, July 1971. 55 p, 9 fig, 8 tab. EPA Program 11023 FDD 07/71. Contract EPA-WQO 14-12-128, Mod. 7.

Descriptors: *Storm runoff, *Screens, *Filtration, Operation and maintenance, Automatic control, Efficiencies, Water quality control, *Waste water treatment, Chemical oxygen demand, *Overflow, Sewers.
Identifiers: *Rotary screening, *Combined sewer overflows, *Suspended solids, Backwashing, Cleaning.

A 60 inch diameter rotating screen cage was subjected to various combinations of rotational speeds and wastewater flows to determine screen durability, solids removal, COD removal, and hydraulic efficiency of rotary fine screening of storm-caused combined sewer overflows. During a screening cycle, a concentrate sensor stopped the sewage pumps, ending the screening phase and initiating a 30 second washing phase during which the screens were automatically washed. At the end of the cleaning phase the pumps re-started automatically and a new cycle began. Such screening effected 54.8% settleable solids removal, 26.6% suspended solids removal, and 15.5% COD removal, on the average. Screening phase duration average 14.6 minutes with average hydraulic efficiencies dropping from 0.880 to 0.668. Ultimate screen life varied from a minimum of 190.5 hours to a maximum of 516 hours with an average of 346. Screens required an average of 3.5 repairs during the life. Alkaline, acidic, and alcoholic agents did not adequately clean the screens, whole chloroform, solvent parts cleaner, soluble pine oil, Zif, Formula 409, and Vestal Eight offered only limited effectiveness. Zep 9658 cleaned the screens effectively, but water quality implications were not determined. Screen rpm in excess of 55, and sewage flows in excess of 3.0 mgd proved disasterous to screen life, and final testing was conducted under these conditions. (Lowry-Texas)
W72-04827

RESEARCH ON DRY-TYPE COOLING TOWERS FOR THERMAL ELECTRIC GENERATION: PART I,
Beck (R. W.) and Associates, Denver, Colo.
John P. Rossie, and Edward A. Cecil.
Copy available from GPO Sup Doc for as PB-206 954, $0.95. Water Pollution Control Research Series, November 1970. 321 p, 65 fig, 34 tab, 4 ref, 5 append. EPA Program 16130 EES 11/70, Contract 14-12-823.

Descriptors: *Cooling, *Thermal power plant, *Economic evaluation, Water pollution control, Heat Exchanger, Waste water treatment.
Identifiers: *Dry Cooling towers.

An economic analysis is made for the use of dry cooling towers in thermal power plants in the United States. Twenty-seven sites were examined providing in each case capital and operating cost for natural and mechanical draft systems both for fossil and nuclear plants. System optimization was based on capital cost, auxiliary power cost, cost due to loss of capacity, and fuel cost. Comparison was made with wet cooling tower systems. With all factors considered, dry towers would be economically competitive with wet cooling tower systems. (Shirazi-EPA)
W72-04829

A SURVEY OF ALTERNATE METHODS FOR COOLING CONDENSER DISCHARGE WATER, TOTAL COMMUNITY CONSIDERATIONS IN THE UTILIZATION OF REJECTED HEAT,
Dynatech Corp., Cambridge, Mass.
N. Smith, and John S. Maulbetsch.
Copy available from GPO Sup Doc for $0.65; microfiche from NTIS as PB-206 816, $0.95. Environmental Protection Agency, Water Pollution Control Research Series November 1970. 57 p. EPA Program 16130 DHS 11/70, Contract 12-14-477.

Descriptors: *Environmental engineering, *Thermal power, *Heat, *Water reuse, *Thermal pollution, Irrigation, Desalinization, Sewage treatment, Industrial use, Municipal use.
Identifiers: *Aquaculture.

The quantities of electric energy consumption and associated heat rejection quantities, their present and projected allocation throughout the different sections of the country, and their relation to other forms of energy consumption are reviewed and tabulated. Thermodynamic constraints on a solution to the thermal pollution problem are defined. Feasibility of possible application of waste heat usage are reviewed in the field of heating and air-conditioning, aquaculture, process industry, irrigation, sewage treatment, desalination, snow or ice melting and integration with municipal water system. (Rainwater-EPA)
W72-04830

AN ENGINEERING-ECONOMIC STUDY OF COOLING POND PERFORMANCE.
Littleton Research and Engineering Corp., Mass.

Copy available from GPO Sup Doc for $1.50; microfiche from NTIS as PB-206 817, $0.95. Environmental Protection Agency, Water Pollution Control Research Series, May 1970. 172 p, 47 fig, 12 tab, 32 ref, 3 append. EPA Program 16130 DFX 05/70, Contract 14-12-521.

Descriptors: *Thermal pollution, *Cooling water, *Ponds, *Design, *Economic evaluation, *Energy budget, Heated water, Heat transfer, Thermal power plants, Economics, Capital costs, Operating costs, Evaporation, Convection, Design data.
Identifiers: *Cooling ponds.

A procedure for predicting the temperature of a thermally loaded captive pond is presented. Using this information, the cooling pond is shown in a special case to have an economic advantage over a cooling tower and to be not much more expensive than a natural body (stream or ocean) of water. This, with the ecological and recreational assets of a captive cooling pond, would seem to encourage their expanded use with large thermo-electric power plants. (EPA abstract)
W72-04831

A CONVENIENT METHOD FOR ISOLATION OF SALMONELLAE FROM SEWAGE AND CONTAMINATED SEA WATER,
Ministry of Health, Tel-Aviv (Israel). Public Health Lab.
Y. Yoshpe-Purer, S. Ricklis, and M. Paist.
Water Res. 5 (3): 113-120. 1971.
Identifiers: Contaminated, Convenient, Isolation, Method, Salmonellae, Sea, Sewage.

A convenient method for isolating salmonellae from sewage and contaminated sea water was introduced. It is based on concentrating the enrichment medium instead of the inoculum, in this work triple strength selenite broth. This method was compared to 2 other ones--membrane filtration and 'Moore pads.' The results were superior to those obtained by membrane filtration and about equal to those of the Moore pads, with less work involved. The rate of isolations attained by the TSS method is quite high-up to 91% positive samples in 1 day. The size of the inoculum did not affect the rate of isolation, up to 5 serotypes were isolated from inocula of 100 ml sea water. The importance of several consecutive platings from the enrichment medium was confirmed.--Copyright 1971, Biological Abstracts, Inc.
W72-04919

ALTERNATIVES FOR THE TREATMENT AND DISPOSAL OF ANIMAL WASTES,
Cornell Univ., Ithaca, N.Y.
Raymond C. Loehr.
J Water Pollut Control Fed. 43 (4): 668-678. 1971. Illus.
Identifiers: Alternatives, Animal, Cattle, Chicken, Disposal, Hog, Wastes.

Increases in the efficiency of USA agricultural production cause greater environmental quality problems. A major one concerns the handling, treatment, and disposal of wastes generated by confinement feeding of cattle, hogs, and chickens. Large volumes of liquid and solid wastes are generated, and odor and dust problems also occur. These wastes contain highly concentrated nutrients. No one treatment process seems best for all situations. Aerobic and anaerobic processes, oxidation ditches, land disposal, drying, incineration, and composting and their various combinations are among the alternatives available at today's level of knowledge and technology. Ammonia release, controlled nitrification and dentrification, and crop or land management seem feasible.--Copyright 1971, Biological Abstracts, Inc.
W72-04937

EFFECTS OF CARBONATE AND MAGNESIUM ON CALCIUM PHOSPHATE PRECIPITATION,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography and Environmental Engineering.
John F. Ferguson, and Perry L. McCarty.
Environ Sci Technol 5 (6): 534-540, 1971. Illus.
Identifiers: Calcium, Carbonate, Magnesium, Phosphate, Precipitation, Treatment, Waste, Water.

The effect of Mg and carbonate on calcium phosphate precipitation was investigated at concentration conditions resembling those in the anaerobic digestion process and at concentration ratios typical of waste waters. Chemically defined systems were allowed to precipitate at constant temperatures (20 deg to 30 deg C). The precipitation time was usually 24 hr, but in some tests varied from 1 min to several wks. After precipitation, pH was determined, solids were separated, and the soluble components measured. Chemical analyses and X-ray diffraction of solids from some tests were made. With Mg present, the phosphate residual decreased gradually; low values were found at pH above 9. Without Mg, local minimum and maximum in the residual phosphate were found, respectively, at pH 8 and 9.5. Calculated activity products and solids analyses supported a hypothesized effect on Mg on the precipitated solids. Higher carbonate concentrations increased the phosphate residual at pH 8 to 11. The effect was reduced in systems with high Mg concentrations.--Copyright 1971, Biological Abstracts, Inc.
W72-04949

HYDROGEN ISOTOPE RATIOS IN A RECYCLING SYSTEM,
Environmental Health Center, Ottawa (Ontario). Public Health Engineering Div.
M. F. Millson.
Journal Water Pollution Control Federation, Vol 43, No 11, November 1971, p 2287-2290. 7 ref.

Descriptors: *Water reuse, *Hydrogen isotopes, *Deuterium, Heavy water, Public health, Toxicity, Aeration, Evaporation, Temperature, Tertiary treatment, Waste water treatment, Water quality control.
Identifiers: *Abundance ratio, *Concentration.

Water shortages and increasing treatment costs have demonstrated that the sources for usable water supplies must some day include reclaimed wastewater. Since such closed loop water supply/wastewater treatment systems are expected to become more common, investigations as to the changes in water quality accompanying such recycling have been initiated. This particular study has revealed a potential hazard in such systems associated with deuterium. Deuterium concentrations in such systems were shown to increase by a factor of 1.08 per recycle due to the preferential removal of the lighter hydrogen isotope in evaporative losses. This small change would normally be of little concern, but a series of recycle supply systems operated in cascade could easily boost the deuterium content to dangerous levels. Since only limited tests have so far been conducted to determine the effect of increased deuterium intake, such a method of operation would raise a potential hazard to public health of unknown degree. (Lowry-Texas)
W72-04967

POLYMERS IN THE FILTRATION OF RAW SLUDGE,
Kansas City Dept. of Water and Pollution Control, Mo.
Glen J. Hopkins, and Roy L. Jackson.
Journal Water Pollution Control Federation, Vol 43, No 4, April 1971, p 689-698. 6 fig, 1 tab, 6 ref.

Descriptors: *Sludge, *Dewatering, *Filtration, Sludge treatment, Separation techniques, Mixing, Design criteria, Automatic controls, Cost analysis, *Waste water treatment, Incineration.
Identifiers: *Polymers, *Sludge conditioning, Filter cake.

The solids handling facilities serving Kansas City's two major treatment plants have been in operation since 1966. Kansas City is the first known major U.S. city where the initial design of new sludge treatment facilities provided solely for the use of polymers as the sludge conditioning agent for vacuum filtration of raw sludge followed by filtration of the filter cake. Initially, the system was set up to feed only cationic polymers, but operational difficulties soon dictated the addition of an anionic polymer also. The operating staff, in conjunction with local consulting engineers, has resolved the operational problems that are inherent in early operations of large untested facilities. Chemical supplies were required to test at plant scale, as well as analytically, their products, and these data combined with competitive bids were used to select the chemicals to be purchased. At the present time, an operating cost of $2.20 per ton of dry solids has been calculated. (Lowry-Texas)

W72-04968

USE OF 14C-GLUCOSE TO STUDY SUBSTRATE REMOVAL BY ACTIVATED SLUDGE,
Rhodes Univ., Grahamstown (South Africa). Dept. of Zoology and Entomology; and Waterloo Univ. (Ontario). Dept. of Biology.
R. D. Robarts, and A. G. Kempton.
Journal Water Pollution Control Federation, Vol 43, No 7, July 1971, p 1499-1506. 5 fig, 1 tab, 12 ref.

Descriptors: *Kinetics, *Metabolism, *Activated sludge, Carbon radioisotopes, Radiochemical analysis, Tracers, Microorganisms, Aeration, Respiration, Laboratory tests, Acclimatization, *Waste water treatment, Biochemical oxygen demand.
Identifiers: *Mass balance, *Instantaneous depletion, Glucose.

A mixture of 14C-glucose and beef extract was used as a synthetic waste to demonstrate that the kinetics of substrate removal by activated sludge can be measured easily and precisely with radioisotopes. Respiration was measured by the evolution of 14CO2, and by working with a closed system it was possible to obtain accurate mass balances. Radioautographic studies demonstrated that the'instantaneous removals' of glucose were caused by a metabolic process because the removals were accompanied by a corresponding increase in 14C in the biomass. Multiple feedings of constant composition resulted in lessening of instantaneous removals with successive feedings until the fourth. Mass balances, determined graphically, showed that as glucose disappeared from solution it was completely taken up by the cells. At most points, more than 95% of the 14C added was accounted for in the mass balance. Only a small amount of radioisotope was needed even for a large amount of sludge, indicating the 14C labeling method to be a practical and accurate method of conducting kinetics investigations. (Lowry-Texas)
W72-04970

MICROSTRAINING OF COMBINED SEWER OVERFLOWS,
Crane Co., King of Prussia, Pa. Cochrane Div.
E. W. J. Diaper, and G. E. Glover.
Journal Water Pollution Control Federation, Vol 43, No 10, October 1971, p 2101-2113. 2 fig, 6 tab, 7 ref.

Descriptors: *Storm drains, *Storm runoff, *Separation techniques, *Screens, Biochemical oxygen demand, Bacteria, Disinfection, Ozone, Chlorination, Flow rates, Cost analysis, *Waste water treatment, Water quality control, Pennsylvania.
Identifiers: *Microstraining, *Combined sewer overflow, Volatile suspended solids, Total suspended solids, *Philadelphia (Penn).

Microstraining of combined sewer overflows in a residential are of Philadelphia with a fine Mark O (23-micro) screen under relatively high throughput conditions produced average suspended solids removals of 91%, with a range from 78 to 98%. Figures for a larger number of tests made with lower throughputs showed a solids removal range from 62 to 96% with an 80% average. Bacterial analyses revealed both reductions and increases across the microstrainer screen, but further major reductions can be easily achieved with chlorine or ozone. BOD removals also demonstrated both increases and reductions but for cases where reductions were recorded., the average reduction was 65%. However, in 8 of the 17 measurements, increases in BOD were recorded. Pretreatment of microstrainer influent by a heavy solids trap and a barscreen is recommended for full scale installations. Costs of bar screening and microstraining would be $10,200/acre of land drained, with chlorination, $11,200/acre drained and with ozonation, $19,800/acre drained. (Lowry-Texas)
W72-04971

TRACE ELEMENT REMOVALS IN ADVANCED WASTEWATER TREATMENT PROCESSES,
Colorado Univ., Boulder. Dept. of Civil Engineering.
K. DanielLinstedt, Carl P. Houck, and John T. O'Connor.
Journal Water Pollution Control Federation, Vol 43, No 7, July 1971, p 1507-1513. 1 fig, 7 tab, 10 ref.

Descriptors: *Trace elements, *Tertiary treatment, *Water quality control, *Chromium, Toxicity, Activated carbon, Adsorption, Coagulation, Sedimentation, Filtration, Lime, Ion exchange, Separation techniques, Metals, *Waste water treatment, Hydrogen ion concentration, Pilot plants.
Identifiers: *Silver, *Selenium, *Cadmium.

Pilot plant studies determine the capability of various tertiary treatment methods for removal of trace elements, particularly cadmium, chromium, copper, lead, selenium, silver, and zinc. The units tested included coagulation, sedimentation, sand filtration, sorption by activated carbon, and ion exchange, thus simulating a possible tertiary treatment process. For each trace metal, a series of four runs was made with the coagulated and settled sample to investigate the behaviour of the sample constituents through the various treatment units. Results demonstrated that the coagulation-settling process removed 97.0%, 94.5%, 9.3%, and 16.2% of Ag+, Cd++, Cr207, and SeO3, respectively. Concentrations in the wastewater influent to the sand were reduced slightly further by filtration. The carbon column then reduced silver by 85.5%, cadmium by 92.6%, chromium by 94.1%, and selenium by 33.7%. Anion-cation exchange removals of silver, cadmium, chromium, and selenium were 91.7, 99.9, 96.0, and 99.7% respectively. These findings may have much future significance in wastewater reuse applications, where excessive trace metal concentrations may be reduced to levels meeting the water quality criteria for a particular reuse application in the course of reducing major constituent concentrations. (Lowry-Texas)
W72-04972

DESIGN AND OPERATION OF AN EXTENDED AERATION PLANT,
Connecticut Univ., Storrs. Dept. of Agricultural Engineering.
Narayana N. Pillai, William C. Wheeler, and Ralph P. Prince.
Journal Water Pollution Control Federation, Vol 43, No 7, July 1971, p 1484-1498. 7 fig, 46 ref.

Descriptors: *Activated sludge, *Aeration, *Organic loading, Sludge, Mixing, Foaming, Sedimentation, Denitrification, Municipal wastes, Microorganisms, Dissolved oxygen, Protozoa, Rotifers, Operation and maintenance, *Waste water treatment, *Treatment facilities.
Identifiers: *Extended aeration, *Package plants, *Suspended solids, Loading rate, Clarifiers, Detention time, Complete mixing.

The extended aeration process was analyzed from a systems analysis standpoint to determine what improvements could be recommended. Mixing and aeration capacity were demonstrated to be critical factors in system performance. Experiments with aeration devices showed that the sudden expansion type of aspirator with air admitted from the sides had good oxygen transfer efficiencies over a wide range of discharges. A recirculating system was also proposed for creating mixing in the tanks. An experimental unit was designed and operated, and subjected to shock organic and hydraulic loadings using domestic wastewater. A denitrification tank introduced before the clarifier prevented sludge from rising in the clarifier. Sludge settling in the clarifier was returned to the aeration tanks through the pump. A final settling tank trapped most of the solids in the effluent. When the system had a detention time of approximately 1 day, an effluent with biochemical oxygen demand and suspended solids below 5 mg/l was obtained. The recirculation and aeration schemes routed the hydraulic loading slowly through the system, offering effective aeration and mixing, and suppressing the formation of foam on the surface of the aeration tank, contributing greatly to the lack of solids in the effluent. Addition of a final polishing tank may be necessary in some cases to control solids, if the other methods do not provide sufficient control. (Lowry-Texas)
W72-04973

SURVIVAL OF COLIFORM BACTERIA IN WASTEWATER TREATMENT LAGOONS,
Arizona State Univ., Tempe. Coll. of Engineering Sciences.
John W. Klock.
Journal Water Pollution Control Federation, Vol 43, No 10, October 1971, p 2071-2083. 8 fig, 7 tab, 28 ref. Bur Redam REG-836 14-06-300-1403.

Descriptors: *Coliforms, *Oxidation lagoons, *Mathematic models, Sampling, Analytical techniques, Hydrogen ion concentration, Oxidation-reduction potential, Metabolism, Viruses, *Bacteria, Waste water treatment.
Identifiers: *Survival, *Most probable number.

A 4000 ft. long, 3 ft. wide, and 3 ft. deep channel, constructed of plastic, was used to determine coliform survival rates in sewage lagoons. One sample of approximately 100 ml was obtained randomly from each of three channels weekly or biweekly and taken directly to the laboratory for analysis. Oxidation potential and pH analyses were performed on 145 samples obtained at various locations within the lagoon. Bacterial die-away was demonstrated to be of exponential form, and described by Nt=NO10-kt, where N is the number of organisms at times O and t days and k is a rate constant. The influences of oxidation potential and pH on the rate constant were evaluated for various pH and oxidation potential ranges, and an equation for determining the numerical magnitude of these influences was developed. Ranges of k are 5 to 10 for sedimentary waste treatment processes, 1.5 to 0.6 for anaerobic digestion, 0.6 to 0.2 for lagoons, 0.4 to 0.15 for polluted waters, and 0.3 to 0.1 for clean waters. (Lowry-Texas)
W72-04976

EVALUATION CRITERIA FOR GRANULAR ACTIVATED CARBONS,
Gulf General Atomic, Inc., San Diego, Calif.
James S. Mattson, and Frank W. Kennedy.
Journal Water Pollution Control Federation, Vol 43, No 11, November 1971, p 2210-2217. 3 fig, 3 tab, 26 ref.

Descriptors: *Activated carbon, *Adsorption, *Isotherms, Kinetics, Diffusion, Laboratory tests, Phenols, Cost analysis, Tertiary treatment, *Waste water treatment.
Identifiers: *Adsorption capacity, *Rate of adsorption, *Rate of attrition, Mechanical attrition, Hydraulic attrition, Regeneration.

The increasing use of granular activated carbon in treatment plants requires the development of improved analytical methods for technical evaluations of granular activated carbons available commercially. Three general parameters of importance have been selected as contributing much to the performance of carbon adsorption systems. These three parameters, adsorption capacity, adsorption rate, and resistance to attrition were examined in detail for commercial and laboratory-produced granular activated carbons. Phenols were used in experiments to determine adsorption capacities, since wastewaters vary widely in composition. Adsorption isotherms were then developed and compared to the isotherms supplied by the manufacturers. Similar experiments were performed using p-nitrophenol as the solute to determine both rate of adsorption and rate of attrition, and these results were also compared with the material supplied by the manufacturer. In all cases, the advantages of evaluating each type of carbon in the

actual application for which it was to be used were apparent. Judicious selection of a material based on these criteria, as well as cost, should help keep physical-chemical and tertiary treatment costs to a minimum. (Lowry-Texas)
W72-04977

OPERATION OF CONVENTIONAL ACTIVATED SLUDGE FOR MAXIMUM PHOSPHORUS REMOVAL,
Weston (Roy F.), Inc., West Chester, Pa.
William F. Milbury, Donald McCauley, and Charles H. Hawthorne.
Journal Water Pollution Control Federation, Vol 43, No 7, July 1971, p 1890-1901. 3 fig, 3 tab, 7 ref.

Descriptors: *Phosphorus, *Activated sludge, *Water quality control, Municipal wastes, Maryland, Mixing, Dissolved oxygen, Temperature, Hydrogen ion concentration, Nitrification, Organic loading, Nutrients, *Waste water treatment.
Identifiers: *Suspended solids, *Baltimore, Sludge volume index.

The Baltimore, Maryland Back River Treatment Plant was the site of intensive testing to determine optimum conditions for phosphorus removal through the activated sludge system. The 20 mgd conventional activated sludge system was subjected to variations in hydraulic and organic loading, temperature, sludge volume index, pH, nitrification, and primary effluent suspended solids, none of which seemed to affect phosphorus removal adversely. The following operational steps were demonstrated to be necessary in producing maximum phosphorus reductions; (1) phosphorus-rich wasted activated sludge must be handled carefully to prevent recycle of phosphorus to the system; (2) the aeration tank must be operated in the plug flow mode; (3) aeration capacity must be maintained such that dissolved oxygen is not limiting (2.0 mg/l or more); (4) activated sludge must be wasted on a continuous basis to avoid abrupt sludge wasting; (5) the aeration tank must be operated at or above a suspended solids range of 1200 to 1300 mg/l and (6) secondary clarifiers must be operated such that development of anaerobic conditions in the sludge blanket and secondary effluent solids are minimized. Operation under these restraints produced in excess of 80% phosphorus reduction over extended periods. (Lowry-Texas)
W72-04978

PROCESS EVALUATION--PHOSPHORUS REMOVAL,
Rex Chainbelt, Inc., Milwaukee, Wis.
Anthony Geinopolos, and Frank I. Vilen.
Journal Water Pollution Control Federation, Vol 43, No 10, October 1971, p 1975-1990. 2 fig, 10 tab, 3 ref.

Descriptors: *Legislation, *Phosphorus, *Tertiary treatment, Sampling, Monitoring, Analytical techniques, Lime, Chemical precipitation, Cost analysis, Water quality control, *Waste water treatment, Wisconsin, Treatment facilities.
Identifiers: *Alum, *Kenosha (Wisc).

Receipt of an order from a state agency requiring 85% phosphorus removal of the Kenosha, Wisconsin wastewater treatment plant prompted an investigation into the amounts currently removed, and the equipment necessary to remove the rest of the required 85%. 20 sets of samplings were made between February 5, 1969 and July 29, 1969, and analysis of the raw data revealed the average soluble phosphorus in the raw influent was 3.4 mg/l, or 523 lb/day. Effluent from the plant contained 370 lb of soluble phosphorus per day, or approximately 331 lbs/day more than was allowed. Chlorination had no detectable effect on phosphorus content. Recommendations for phosphorus removal included the use of alum and lime introduced between the primary tank and the return sludge line, between the return sludge line and the aeration tank, or between the aeration tank and the final tank. Chemical requirements included 6342 lb/day of alum and 848 lb/day of 95% pure CaO at an estimated cost of $200.46/day. Space, construction, and equipments were comparatively minimal. (Lowry-Texas)
W72-04979

FORMS OF INORGANIC NITROGEN IN DOMESTIC WASTEWATER,
Wisconsin Univ., Madison. Water Chemistry Program.
For primary bibliographic entry see Field 05A.
W72-04981

ALGAL-BACTERIAL SYMBIOSIS FOR REMOVAL AND CONSERVATION OF WASTEWATER NUTRIENTS,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering; and North Carolina State Univ., Raleigh. Dept. of Civil Engineering.
Frank J. Humenik, and George P. Hanna, Jr.
Journal Water Pollution Control Federation, Vol 43, No 4, April 1971, p 580-594. 9 fig, 1 tab, 27 ref.

Descriptors: *Algae, *Bacteria, *Symbiosis, Photosynthesis, Oxidation, Respiration, Oxygenation, Temperature, Light intensity, Mixing, Dissolved oxygen, Metabolism, Carbon dioxide, Phosphates, Nitrates, *Nutrients, Alkalinity, Chemical oxygen demand, Analytical techniques, Tertiary treatment, *Waste water treatment.

A laboratory-scale continuous symbiotic algal-bacterial system was developed that removed nutrients from wastewater and remained without supplemental aeration. The biomass growth unit supported a mixed Chlorella-activated sludge culture. Maximum and most consistent nutrient removal and conservation occurred during unaerated operation with solids control by daily harvesting. Phosphorus removals were not significant. The biomass culture was an intimately associated mixture of algae and activated sludge, and the resulting symbiotic benefits presented more favorable conditions for the removal and conservation of wastewater nutrients. The reestablishment of the symbiotic algal-bacteria system after an equipment failure provides evidence that such a process could be recovered after some operational mishap had made it necessary to revert to supplemental aeration. (Lowry-Texas)
W72-04983

IDENTIFICATION OF FILAMENTOUS MICROORGANISMS IN ACTIVATED SLUDGE,
Wisconsin Univ., Madison. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05B.
W72-04984

THE ECONOMIC FEASIBILITY OF TREATING TEXTILE WASTES IN MUNICIPAL SYSTEMS,
Clemson Univ., S.C.
Kimrey D. Newlin.
Journal Water Pollution Control Federation, Vol 43, No 11, November 1971, p 2195-2199. 20 ref.

Descriptors: Textiles, *Biodegradation, *Municipal wastes, *Industrial wastes, Nutrients, Hydrogen ion concentration, Toxicity, *Cost analysis, Construction cost, Operation and maintenance, Research and development, *Waste water treatment.
Identifiers: *Textile wastes.

A literature review was conducted to establish the characteristics of textile wastes, their suitability for joint treatment with municipal wastes, and cost analyses for such treatment. Textile wastes were generally found to contain a very high BOD, largely carbonaceous. Therefore, they should lend themselves well to biological treatment provided the pH is reasonable and provided that supplemental nutrients be made available. Since municipal wastes could readily supply the necessary nutrients, joint treatment of textile wastes and municipal wastes would appear favorable at this time. However, no simple, single solution to the problem of treating textile wastes, or estimates of the costs associated with such treatment are available since advances are continually being made both in processing textiles and in treatment of textiles. Examples of individual applications of various treatment methods and costs are included. (Lowry-Texas)
W72-04989

DUAL SUBSTRATE UTILIZATION BY ACTIVATED SLUDGE MICROFLORA,
Vanderbilt Univ., Nashville, Tenn. Dept. of Environmental and Water Resources Engineering.
John A. Carter, and George W. Malaney.
Water and Sewage Works, Vol 118, No 12, December 1971, p 411-415. 8 fig, 7 ref.

Descriptors: *Activated sludge, *Oxidation, *Acclimatization, Enzymes, Additives, Metabolism, Microorganisms, Laboratory tests, *Waste water treatment, *Municipal wastes, Biological treatment.
Identifiers: *Process control, *Glutamic acid, Stimulation, Substrate.

Activated sludge microflora from a conventional municipal waste treatment plant, exposed to dual combinations of representatives of alkanes, ketones, amino acids, and aromatic hydrocarbons, in most cases exhibited preferential oxidation of one of the two compounds in the system. The compound of choice, namely the substrate that will be used first, was predicted from the time periods required by the organisms to begin oxidation of the individual compounds. Glutamic acid seemed to stimulate increased utilization of undercanone, tridecane, and catechol. These results indicated the possible utility of glutamic acid, and possibly other untested compounds, as additives in aerobic biological waste treatment to increase the degradation and removal of refractory materials. Combination of different types of wastes, therefore, may greatly facilitate biological treatment in some instances, resulting in an increase in treatment efficiency. (Lowry-Texas)
W72-04990

RECENT EXPERIENCES IN PLANT-SCALE APPLICATION OF THE SETTLING TUBE CONCEPT,
Neptune Microfloc, Inc., Corvallis, Oreg.
Alfred F. Slechta, and Walter R. Conley.
Journal Water Pollution Control Federation, Vol 43, No 8, August 1971, p 1724-1738. 17 fig, 3 tab, 4 ref.

Descriptors: *Activated sludge, *Trickling filters, *Sedimentation, Separation techniques, Scum, Fouling, Pilot plants, Operation and maintenance, *Waste water treatment.
Identifiers: *Settling tubes, *Clarification, Settleable solids, Suspended solids, Primary sludge.

Clarification with tube settlers was practiced at plant scale for both primary clarification of raw wastewater and secondary clarification of activated sludge and trickling filter solids. Settling tubes can be used to improve quality and possible increase capacity in systems with serious solids carry-over problems. A zone for collection and removal of scum and grease must be provided upstream of the effluent. Removal of settleable solids and 40 to 60% removal of suspended solids can be achieved with 2 ft. settling tubes having a settling depth of 2 inch at a rate of 3 gpm/sq. ft. Simple cleaning procedures must be practiced to maintain high solids removal efficiencies. With settling tubes, it was possible to separate activated sludge directly in an aeration basin without mechanical sludge removal and related return-sludge pumping facilities, while protecting the final clarifier from severe solids losses due to up-

sets in the biological process or peak flow conditions. (LowrygTexas)
W72-04991

ACCUMULATIONS OF CERTAIN PESTICIDES IN ADIPOSE TISSUES AND PERFORMANCE OF ANGUS, HEREFORD, AND HOLSTEIN STEERS FED APPLE PROCESSING WASTES,
Pennsylvania State Univ., University Park. Dept. of Animal Science.
L. L. Wilson, D. A. Kurtz, J. H. Ziegler, M. C. Rugh, and J. L. Watkins.
Journal of Animal Science, Vol 31, p 112-117, 1971. 4 tab, 17 ref.

Descriptors: Waste disposal, *Solid wastes, *Pesticides, Apples, *DDT, Heptachlor, Aldrin.
Identifiers: *DDE, *TDE, Herefords, Holsteins, Angus, Cod fat biopsie, Carcass tracts, Metabolites, *Apple processing wastes, *Adipose tissue.

The nutritive value of apple wastes has been reported by several researchers, but because of the content of several pesticides in apple waste, the feeding of processing wastes to cattle has been questioned. Three of the pesticides investigated were DDT, DDE, and TDE. A study was conducted to: (1) determine the concentration of pesticide residues in fat from Angus, Hereford, and Holstein steers fed apple wastes and (2) to determine the ration replacement value of dried apple waste for standard cattle finishing feeds. The apple waste was composed of peelings, cores, and cull apples and were pressed in a 0.099 m3 Willmes Presser. The waste contained 0.45, 0.52, and 1.30 ppm of DDT, DDE, and TDE respectively. Three trials were run. The length of each trial differed as did the ratio of haylage to concentrate to waste. Trials one and two used Herefords and Holsteins while trial three used only Angus cattle. Within all trials, the rations of the different lots were formulated to allow equal estimated digestible energy intake and 12% protein equivalent based on proximate analyses and National Research Council tabular data. Daily gains within any trial were similar. Measures of fat deposition were significantly less for Holsteins than for Herefords. However, concentrations of pesticide residues of fat from Holsteins and Herefords were similar. Although the fat of waste-fed cattle contained significantly more total DDT residue than did fat of cattle not fed waste, the results indicated that low to moderate levels of apple waste may be used in cattle finishing rations. (Biggs-Texas)
W72-04992

TOUGHEST AIR/WATER RULES MET BY NEW KRAFT MILL AT HALSEY, OREGON,
M. D. Sullivan.
Pulp and Paper, Vol 44, No 5, May 1970, p 63-67. 5 fig.

Descriptors: Oregon, *Air pollution, *Sawmill, Sawdust, Evaporators, Lime, Chemical precipitation, Salt, Alabama, Filtration sumps, Potassium, Chlorine, Pulp and paper industry, Oil, Natural gas, *Pulp wastes, Waste water treatment, *Treatment facilities.
Identifiers: *Halsey (Oregon), Scrubber, Kiln, Malodorous gases, Naheola, Centrifuge.

Anticipating public opposition to its new $40 million West Coast manufacturing plant, American Can made special efforts to design a plant which could contribute to the economy of the area without sacrificing the quality of the environment. Designed to operate solely on sawmill residuals, the Halsey mill represents the blending of North American and Swedish technology for the control of air emissions. The new plant has no direct contact evaporator. To simplify evaporation, the Swenson sextuple-effect evaporators are augmented with a forced concentration unit in a split seventh effect. The evaporation plant has a capacity of 280,000 pounds of water. A Venemark scrubber is installed in the evaporator vacuum train. Elimination of fallout was effected with the use of a dual-chamber Research-Cottrell electrostatic precipitator which is guaranteed to achieve 99.5% efficiency. With few exceptions, the recausticizing plant is of conventional design. The use of fresh water is curtailed through an extensive reclaiming and reuse system. To reduce the possibility that strong effluent might enter the main sewer, sumps are located in all process areas. New and proven equipment such as Bauer M and D continuous digesters are used in the pulp mill. The paper machines used have speeds up to 5000 fpm and slitters on those machines save time. Flash dried pulp also provides flexibility. The power supply can use either natural gas or fuel oil. With automated chip and sawdust handling instrumentation aimed at computerization and many new features, the Halsey plant expects to meet new standards to be enforced in 1975. (Biggs-Texas)
W72-04993

MULTIPLE WATER REUSE,
El Paso Products Co., Odessa, Tex.
F. Smythe.
Journal of the American Water Works Association, Vol 63, No 10, October 1971, p 623-625. 2 tab.

Descriptors: *Sewage effluent, *Sewage treatment, *Water reuse, Texas, Flocculation, Activated sludge, Aeration, Pumps, Lagoon, Biochemical oxygen demand, Lime, Calcium, Ammonia, Sodium chloride, Hydrogen, Hydrogen ion concentration, Waste water treatment.
Identifiers: *Odessa (Texas), Clarifier, Backwash, Surge tanks, Sodium zeolite, Hydrogen zeolite.

El Paso Products Company, Odessa, Texas, is now successfully using city sewage effluent for industrial water. The complex requires 7 mgd water, all of which is treated in facilities owned and operated by El Paso Products. Some 6 mgd of this amount is supplied by the City of Odessa's sewage treatment plant. The Odessa treatment plant is a typical activated sludge treatment type containing primary and secondary treatment facilities. When the final BOD reduction has been attained transfer pumps ship the effluent to El Paso's holding lagoon. Water from the holding lagoon goes to a cold lime treater to remove phosphates and suspended solids. Next the effluent is recarbonated to convert carbonate and hydroxyl ions to the soluble bicarbonate form and thereby prevent deposition of calcium carbonate in water conditioning equipment. After recarbonation, the water must be filtered for further use. The filtered water is stored in a surge tank, and then taken and split into two streams, one of which goes to sodium zeolite exchangers and the other to hydrogen zeolite exchangers. After softening the streams are blended together and sent on to degasifers. After some further processing the split-stream water is used for cooling-tower makeup and as makeup to the low-pressure boilers. A small stream of the hydrogen zeolite water is deionized for high-pressure boiler makeup. Primary control of cooling-tower water is by means of conductivity with periodic tests run for pH, chromate residual, alkalinity, and dispersant. (Biggs-Texas)
W72-04994

ANAEROBIC DIGESTION II. THE CHARACTERIZATION AND CONTROL OF ANAEROBIC DIGESTION,
National Institute for Water Research, Pretoria (South Africa).
J. P. Kotze, P. G. Thiel, and W. H. J. Hattingh.
Water Research, Vol 3, 1969, p 459-494. 1 tab, 175 ref.

Descriptors: *Anaerobic digestion, *Kinetics, *Biochemistry, Fermentation, Energy conversion, Methane, Bacteria, Hydrogen ion concentration, Alkalinity, Sludge, Metabolism, Protein, Nutrients, Organic loading, *Waste water treatment, *Reviews.
Identifiers: *Process characterization, *Process control, *Substrates.

Although well-operating digesters will always have a common feature in that organic material is eventually converted to methane and carbon dioxide, their bacterial populations, the sequence of reactions giving rise to end products, and the prevailing environmental conditions may differ widely. Digester character is dependent upon substrate composition and the number of species of microorganisms present in the inoculum, as well as temperature, loading rate, hydraulic residence time, sludge retention time, method of mixing sludge in the digester and the design of the container of the process. An extensive literature search resulted in a summary and description of digester characterization factors, and revealed that substrate composition and feeding rate were of greater influence than temperature, original inoculum, and mode of operation. Reference was made to such generally accepted ways of characterizing a digester as pH, volatile fatty acid concentration, alkalinity, gas production rate and composition, etc., with the realization that these parameters do not account for the intrinsic biological nature of the process bacteria. The analysis also revealed the paucity of knowledge of the biochemistry of the anaerobic digestion process, and the obvious priority that such knowledge must take in attempting to provide efficient and reliable characterization and control of an essentially biological process. (Lowry-Texas)
W72-04995

MICROSTRAINING PAPER MILL WASTEWATER,
Camp, Dresser and McKee, Boston, Mass.
Alan E. Rimer.
Journal Water Pollution Control Federation, Vol 43, No 7, July 1971, p 1528-1540. 8 fig, 8 tab.

Descriptors: *Pulp wastes, *Turbidity, *Coagulation, Hydrogen ion concentration, Temperature, Flow rates, Biochemical oxygen demand, Color, Sludge, Industrial wastes, Construction costs, Operation and maintenance, Pilot plants, *Waste water treatment, Treatment facilities.
Identifiers: *Microstraining, *Polyelectrolytes, *Sodium aluminate, Suspended solids.

Esleeck Manufacturing Company and the Strathmore Paper Company have completed successful studies on the application of microstraining alone, and coagulation followed by microstraining for treatment of their wastewaters, consisting chiefly of excess whitewater. Three primary coagulants and 12 polyelectrolytes were tested to find the optimum combination for the coagulation step. Influent to the 25 gpm pilot plants operated separately at the two plants averaged 140 to 180 mg/l suspended solids, and 20 mg/l BOD. Analyses conducted included solids analyses, turbidity determinations, pH determinations, temperature, and flow, as well as BOD and color analyses. Average doses of 1.0 mg/l of polyelectrolyte and 25 to 100 mg/l of sodium aluminate were used in the coagulation process. Average removals of 95% of the 2100 kg/day of suspended solids and 85% of 5-day BOD were achieved with coagulation followed by microstraining. Effluent turbidity averaged 40 JTU. Turbidity reductions of 57 and 55% were achieved with microstraining alone at Strathmore and Esleeck respectively, but the turbidity varied considerably during any one day and over the period of study due to changes in the mill effluent. Construction costs for a coagulation-microstrainer system to treat the wastes from both mills were estimated to be $644,000, with yearly operating costs of $32,500. Waste sludge will be disposed of at the municipal plant. (Lowry-Texas)
W72-04996

THE TOTAL ORGANIC CARBON ANALYZER AND ITS APPLICATION TO WATER RESEARCH,
Washington Univ., Seattle. Water Biology.
For primary bibliographic entry see Field 05A.
W72-05001

DISPOSAL OF INSULATION BOARD MILL EFFLUENT BY LAND IRRIGATION,
Celotex Corp., Lansing, Mich.
A. H. Philipp.
Journal Water Pollution Control Federation, Vol 43, No 8, August 1971, p 1749-1754.

Descriptors: *Pulp wastes, *Industrial wastes, *Sprinkler irrigation, Precipitation (Atmospheric), Infiltration, Adsorption, Bacteria, Nutrients, Biochemical oxygen demand, Lagoons, Aeration, Odors, Hydrogen sulfide, Construction costs, Operation and maintenance, Waste treatment, *Waste disposal.

An insulation board mill has provided a settling pond and storage ponds for its industrial effluent, for solids removal and effluent storage during the winter months (October through April). From May through October, the effluent is pumped from the storage lagoons and used to irrigate 100 acres of Reed Canary grass. Wastewater discharge from the plant averages 350 gpm. Sanitary wastes are segregated in the plant and pumped to the village wastewater treatment plants, while the innocuous process wastes, containing 1950 mg/l BOD at a slightly acid pH are sprayed on the land. Total annual rainfall has averaged less than 40 inches in the past 3 years with approximately 27 inches occurring before the spraying season. Hydraulic loading on the system is 0.55 in/day/acre, making a total of 105 in. with the natural precipitation. BOD determinations at the subsurface drainage outfall indicate that BOD removals well in excess of 99% are common. Total construction cost of the system was $440,000, and less than $20,000 is required for total yearly operating costs. (Lowry-Texas)
W72-05002

REDESIGNING EXISTING FACILITIES TO INCREASE HYDRAULIC AND ORGANIC LOADING,
Greater Peoria Sanitary and Sewage Disposal District, Ill.
Edwin B. Fall, Jr.
Journal Water Pollution Control Federation, Vol 43, No 8, August 1971, p 1695-1701. 6 fig, 3 tab, 5 ref.

Descriptors: *Waste water treatment, *On-site investigations, *Design criteria, Planning, Aeration, Oxidation, Separation techniques, Sedimentation, *Organic loading, Head loss, Pumping, Treatment facilities.
Identifiers: *Hydraulic loading, *Facilities redesign, Kraus process, Short circuiting, Retention ponds.

A wastewater treatment plant was constructed by the Greater Peoria Sanitary District in 1928 to handle a maximum of 30 mgd raw wastewater flow from a population equivalent of 200,000. Raw flows and population equivalents for previous years of operation were used to develop projected loadings for 1995 of 35 mgd average flow and 70 mgd maximum flow. Numerous in-plant tests and studies were conducted to determine whether or not the plant could be redesigned to such an extent as to be able to handle the increased flows. Primary settling tanks, which were especially prone to short-circuiting, were redesigned to the extent that theoretical detention time and actual detention time were identical, and solids removal efficiencies were unaffected at inflow settling rates up to 4100 gpd/sq. ft. The final settling tanks were similarly redesigned. The aeration tank was modified to use the Kraus process, three rows of porous plates were added along the opposite side of the tanks from the original plates, and new gas-engine driven air blowers were installed. A polishing retention pond was also added. Complete details for each of the projects are presented. In-plant tests were shown to be of inestimable value in improving the capacity and efficiency of treatment works. (Lowry-Texas)
W72-05004

ADVANCED ORGANICS REMOVAL BY PULSED ADSORPTION BEDS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
Robert L. Johnson, and E. Robert Baumann.
Journal Water Pollution Control Federation, Vol 43, No 8, August 1971, p 1641-1657. 11 fig, 11 tab, 20 ref.

Descriptors: *Adsorption, *Interfaces, *Boundary processes, *Organic matter, Bacteria, Metabolism, Oxidation, Chemical oxygen demand, Biochemical oxygen demand, Organic loading, Sands, Anthracite, Activated carbon, Particle size, Pilot plants, Design criteria, Cost analysis, *Waste water treatment.
Identifiers: *Pulsed adsorption beds.

Sand, anthracite coal, and activated carbon were tested as media for pulsed adsorption beds (PAB). The PAB process involves the adsorption of organic materials by the media, concentrating the organics so that biodegradation could proceed efficiently. Subsequent testing showed that the PAB process can be readily incorporated into a wastewater treatment system either as PAB units operating alone, providing removal of material lost by bacterial oxidation, or as a PAB-Multimedia filter combination, providing removals of both the oxidized and the synthesized fractions. Preliminary pilot plant field data from only a 3 ft deep filter bed reported a 77% removal of organics, with a 60 to 90% range expected for most applications. A 10 mgd system, based on the PAB-Multi-media filtration combination could be designed, built, and operated at a total cost of approximately $0.04/1000 gallons treated. (Lowry-Texas)
W72-05005

ABATEMENT OF POLLUTION FROM A POULTRY PROCESSING PLANT,
Maine Univ., Orono. Dept. of Civil Engineering.
Otis J. Sproul, Franklin E. Woodard, Millard W. Hall, and Mringanka M. Ghosh.
Preprint presented at 44th Annual Conference of Water Pollution Control Federation, Session 7, No 5, October 5, 1971, p 17. 2 fig, 6 tab, 3 ref.

Descriptors: *Industrial wastes, *Poultry, *Flotation, Laboratory tests, Design criteria, Pressure, Biochemical oxygen demand, Coagulation, Separation techniques, Operation and maintenance, Cost analysis, *Waste water treatment, Pollution abatement, Operating costs.
Identifiers: *Suspended solids, Grease, *Waste characterization, Flow reduction, In-plant modifications, Viscera.

All waste streams from a poultry processing were sampled and analyzed so that each waste stream could be characterized. In-plant modifications were then instituted, with the objectives of reducing the total water consumption from 0.9 mgd to 0.6 mgd, instituting dry clean-up methods where possible, and replacing the viscera carriage. Many of the changes have been implemented, and others are pending approval by Federal authorities. Coagulant dosage, recycle rates, rise rate, and volume of float for an air flotation unit were investigated in bench scale laboratory tests, and design criteria for a full scale unit developed. Typical plant results demonstrated that BOD removals in excess of 80%, suspended solids removals in excess of 90%, and grease removals in excess of 98% could be obtained. Underflows were clear with no visible appearance of grease or blood and had very low turbidities. Operating costs were $104 per day excluding maintenance, while the value of solids and grease recovered was $250. This excess over cost was more than enough to cover the cost of capital repayment, interest, and maintenance of the facility. (Lowry-Texas)
W72-05006

INFLUENCE OF TEMPERATURE ON ANAEROBIC DIGESTION,
Central Sewage Treatment Plant, Brno (Czechoslavakia).
Josef Maly, and Hubert Fadrus.
Journal Water Pollution Control Federation, Vol 43, No 4, April 1971, p 641-650. 7 fig, 4 tab, 11 ref.

Descriptors: *Anaerobic digestion, *Fermentation, *Temperature, Sludge, Kinetics, Bacteria, Carbon dioxide, Methane, Ammonia, Proteins, *Waste water treatment.
Identifiers: *Reaction rate.

The relationship between the rate and degree of organic matter digestion in sludge and the temperature at which methane fermentation takes place was investigated both through the literature and in a series of laboratory tests. Sludge gas production and organic matter removals were determined for batch fermentation units at 20 deg C, 30 deg C, and 50 deg C. Increased temperature resulted in an increased rate of bacterial decomposition, but the resulting effect and final state of the process, as determined from removals of organic matter, organic carbon, and methane and CO2 production, were nearly identical for the different temperatures, provided sufficiently long fermentation periods were utilized. At higher sludge fermentation temperatures more ammonia would be evolved, due to failure of methane fermentation rate to increase with temperature. This ammonia evoluation from the high-molecular-weight nitrogenous compounds and their decomposition products would not always be accompanied by total mineralization. (Lowry-Texas)
W72-05010

PHOSPHORUS REMOVAL BY LUXURY UPTAKE,
Greater Manassas Sanitary District, Prince William County, Va.
M. C. Mulbarger, M. C. Murphy, D. G. Shiflett, and D. D. Huffman.
Journal Water Pollution Control Federation, Vol 43, No 8, August 1971, p 1617-1628. 3 fig, 7 tab, 16 ref.

Descriptors: *Activated sludge, *Phosphates, *Separation techniques, Anaerobic conditions, Flotation, Design criteria, Performance, Cost analysis, *Waste water treatment, Evaluation.
Identifiers: *Biological luxury uptake.

A 1.0 mgd wastewater treatment plant designed for biological phosphorus removal by luxury uptake within the activated sludge system was evaluated at a wide range of operating variables. Primary clarification was eliminated to provide greater solids levels for removing phosphorus, and dissolved air flotation was used in lieu of secondary settling to prevent occurrence of anaerobic conditions and subsequent phosphate release. Anaerobic digestion of waste sludge released the phosphates in the elutriate, where they could be removed chemically if necessary. Enhanced phosphorus removals were demonstrated to occur through a combination of metabolic and physical-chemical mechanisms that are incompletely understood. Maximum phosphorus: COD removal ratio was 0.026 at a first-stage CRT of 3.6 days. Removals were not subject to precise controls, since the internal metabolic and/or chemical precipitation mechanisms were limited by the variability of the wastewater quality and the activated sludge system performance. Cost of the system was 2 to 3 times the cost of conventional activated sludge systems. Therefore, such designs should be avoided, and high level phosphorus removals, if they occur in some installations, should be treated as a bonus. (Lowry-Texas)
W72-05011

PUMPING SLUDGE LONG DISTANCES,
Potter (Alexander) Association, New York.
Anton E. Sparr.
Journal Water Pollution Control Federation, Vol 43, No 8, August 1971, p 1702-1711. 1 tab, 25 ref.

Descriptors: *Sludge, *Pumping, *Pipes, Anaerobic digestion, Viscosity, Velocity, Laminar flow, Turbulent flow, Fluid friction, Particle size, Head

loss, Deposition (Sediments), Linings, Activated sludge, Operation and maintenance, Sludge treatment.
Identifiers: *Primary sludge, *Grease.

Sludge is produced in wastewater treatment as raw primary sludge, waste activated sludge, digested sludge, and heat treated combinations of any or all of the above. Head loss due to friction of a line varies directly with the viscosity of the flowing sludge. Apparent viscosity decreases with increasing velocity of flow in the pipe in the laminar zone. Increased velocity in the turbulent zone continues to decrease apparent viscosity until the true viscosity is reached. Particle size reduction results in reduced viscosity. Effective grit removal is mandatory for economical pumping. Low velocities in the laminar zone for raw primary sludge often result in grease deposition on the walls. Friction losses are less for anaerobically digested sludge than primary sludge of the same dry solids content. Turbulent flow region flow velocities tend to prevent grease deposition within the pipe. Maximum economy is realized by pumping at velocities in the lower portion of the turbulent zone. Pipeline materials and linings influence head losses and grease deposition. (Lowry-Texas)
W72-05013

ANALYTICAL PARAMETERS OF PETROCHEMICAL AND REFINERY WASTEWATERS,
Engineering-Science, Inc., Texas, Austin.
D. L. Ford, J. M. Eller, and E. F. Gloyna.
Journal Water Pollution Control Federation, Vol 43, No 8, August 1971, p 1712-1723. 9 fig, 3 tab, 9 ref.

Descriptors: *Correlation analysis, *Industrial wastes, *Regression analysis, *Chemical oxygen demand, *Biochemical oxygen demand, Analytical techniques, Oxidation, Acclimatization, Waste water treatment.
Identifiers: *Total organic carbon.

The organic content of industrial wastewaters is commonly characterized by the BOD, COD, or TOC analyses. Correlation of these parameters is necessary, since regulatory agencies accept only BOD and COD measurement, while TOC or TOD is being used by industries because of the availability of automated techniques. Tests have demonstrated that the probability of developing a useful correlation between the various parameters is best when wastewater concentration is high and product diversity is low. The realtionship between the parameters is generally linear and best characterized by a least squares regression line. COD to TOC correlations were better than either BOD to TOC or BOD to COD in most cases studied. Any established correlations should be checked periodically, since process modifications or operational changes can greatly affect the relationship. However, when carefully developed, such correlations provide an indication of the degree of biological treatment obtainable at a substantial savings in analytical expense and time. (Lowry-Texas)
W72-05014

TOXIC EFFECTS OF AMMONIA NITROGEN IN HIGH-RATE DIGESTION,
New York City Environmental Protection Administration. Dept. of Water Resources.
N. R. Melbinger, and J. Donnellon.
Journal Water Pollution Control Federation, Vol 43, No 8, August 1971, p 1658-1668. 4 fig, 6 tab, 4 ref.

Descriptors: *Digestion, Ammonia, *Toxicity, Inhibition, Sludge, On-site investigations, Alkalinity, *Nitrogen, Acclimatization, Methane, Bacteria, *Waste water treatment.
Identifiers: *Digester failure, *Recirculation, Ammonia nitrogen.

Although previous investigators had established 1700 to 1800 mg/l as the toxicity threshold for ammonia nitrogen in digesters, operating experience had revealed several instances of digesters operating in excess of these levels in various New York City Wastewater Treatment Plants. A series of digester failures starting in 1967 caused renewed interest in investigating the actual mechanisms. Monitoring of the digesters revealed that the ammonia nitrogen becomes toxic in a digester only when the rate of its formation above a 1700 to 1800 mg/l threshold limit is increasing more rapidly than the acclimation of methane-forming organisms. Control of the rate is possible by proper digester feeding, using the volatile acid: alkalinity ratio as a parameter, and ammonia nitrogen concentrations of 2700 mg/l have existed in acclimated digesters with no loss of efficiency. Controlled recirculation of digested sludge to the thickener has been used to control the ammonia nitrogen concentrations also. Finally, a definite relationship exists between the sludge ammonia nitrogen content and the digested sludge volatile solids and alkalinity. (See also W72-05016) (Lowry-Texas)
W72-05015

DISCUSSION OF 'TOXIC EFFECTS OF AMMONIA NITROGEN IN HIGH RATE DIGESTION',
Bergen County Sewer Authority, Little Ferry, N.J.
Herman R. Zablatzky.
Journal Water Pollution Control Federation, Vol 43, No 8, August 1971, p 1668-1670. 11 ref.

Descriptors: *Anaerobic digestion, *Ammonia, *Acclimatization, Toxicity, Inhibition, Acids, Alkalinity, Methane, Sludge, Foaming, Odors, *Waste water treatment.
Identifiers: *Solids disposal.

Results of the work performed by Melbinger and Donnellon indicate that possibly many of the old toxicity levels should be re-evaluated to consider possible acclimation effects. However, two requirements specified by them may limit the number of plants to which their own investigations may be directly applied. The plants would require some form of the activated sludge process, and undigested sludge thickening before digestion. In addition plant location and method of solids disposal can alter the degree of anaerobic treatment desired, affecting the quantity and quality of the intermediate and end products. The effects of these intermediate and end products on the process must also be considered. In addition, there may be a ratio of ammonia nitrogen to alkalinity that may depend on specific types and concentrations of sludges and allow the alkalinity to be used as an easy reference point for the inhibiting level of ammonia nitrogen. (See also W72-05015) (Lowry-Texas)
W72-05016

ENERGY PRODUCTION IN ANAEROBIC ORGANISMS,
Freiburg Univ. (West Germany). Bichemisches Institut.
K. Decker, K. Jungermann, and R. K. Thauer.
Angewandte Chemie, International Edition in English, Vol 9, No 2, 1970, p 138-158. 11 fig, 9 tab, 116 ref.

Descriptors: *Anaerobic bacteria, Energy transfer, Phototrophism, *Enzymes, *Oxidation-reduction potential, *Anaerobic conditions.
Identifiers: *Energy production, Chemotrophism, Adenosine triphosphate (ATP).

Biological energy production was believed by Lavoisier to depend upon oxidations with atmospheric oxygen. This view was held for more than a century. We now know that during the earliest phases of the development of our earth that energy could not have been produced by combustion reactions since the atmosphere at the time was oxygen free. Therefore, it is probable that the earliest forms of life on our planet were anaerobes. 'Life without oxygen' still occurs on earth wherever natural processes give rise to niches of oxygen deficiency. In an anaerobic system, biological redox processes are required for the synthesis of 'energy rich' compounds which are in an enzyme-controlled equilibrium with the general energy carrier adenosine triphosphate (ATP). The basic mechanisms of biological energy transformation are substrate level phosphorylations (SLP) and electron transport phosphorylations (ETP). In anaerobic catabolism the numerous nutrients are channelled into only a few substrate level phosphorylations; the occurrence in chemotrophic anaerobes of energy conservation coupled to electron transport has not yet been demonstrated unequivocally. At present, the determination of the ATP turnover in growing cells appears to be a promising method of approaching this problem. The existing knowledge of oxygen dependent enzyme reactions and their molecular evolution provides the basis for a biochemical definition of aerobic and anaerobic organisms. (Goessling-Texas)
W72-05018

NITRIFICATION AND DENITRIFICATION IN ACTIVATED SLUDGE SYSTEMS,
Environmental Protection Agency, Manassas, Va. Advanced Waste Treatment Research Lab.
M. C. Mulbarger.
Journal Water Pollution Control Federation, Vol 43, No 10, October 1971, p 2059-2070. 8 fig, 3 tab, 12 ref.

Descriptors: *Nitrification, *Denitrification, *Pilot plants, Trickling filters, Coagulation, Activated sludge, Nitrogen, Ammonia, Nitrates, Nitrites, Toxicity, Hydrogen ion concentration, Alkalinity, Temperature, Aeration, Mixing, Oxidation, Dissolved oxygen, Filtration, Sampling, Performance, *Waste water treatment.
Identifiers: *Methanol.

Trickling filtration, addition of inorganic or organic coagulants to the primary clarifier to maximize solids removal and eliminate the high rate activated sludge system, utilization of anaerobic columns or beds, and several modifications of the activated sludge process were evaluated at pilot plant scale (0.2 mgd) for efficiency of nitrification and denitrification. The three sludge activated sludge system offered the most dependable, consistent performance for achieving nitrification. Additional cost of nitrification with such a system was estimated to be within 10% of the cost of conventional activated sludge treatment. Alkalinity depletion caused by nitrification was demonstrated to be less than that theoretically predicted, but in low-alkaline wastewater the depletion may be of sufficient magnitude to warrant pH control through addition of an external alkalinity source. (Lowry-Texas)
W72-05019

AUXILIARY SEWAGE STORAGE SYSTEM FOR TEMPORARILY STORING SEWAGE,
Aerojet-General Corp., El Monte, Calif.
Benjamin Franklin Rose, Jr.
U. S. Patent No. 3,503,413, 4 p, 2 fig, 9 ref; Patent Abstracts Section, Official Gazette, Vol. 872, No. 5, p. 1499, March 31, 1970.

Descriptors: *Patents, *Sewage treatment, Pollution abatement, *Treatment facilities, *Waste water treatment, *Liquid wastes, Water purification, Water pollution control, Storage.
Identifiers: *Sewage storage.

The auxiliary sewage storage system consists of one or more flexible storage bags connected into a by-pass conduit arrangement. When the sewage treatment plant is operating at capacity under peak load conditions, a valve in a by-pass conduit is opened so as to direct additional raw sewage to the flexible storage bags for temporary storage. (Sinha-OEIS)
W72-05022

WASTE WATER TREATMENT PHOSPHATE REMOVAL BY IRON OXIDE,
Johns-Manville Corp., New York.
Karlis Laimonis Jaunarajs.
U. S. Patent No. 3,499,837, 5 p, 6 tab, 7 ref; Patent Abstracts Section, Official Gazette, Vol. 872, No 2, p 523, March 10, 1970.

Descriptors: *Patents, *Waste water treatment, Waste treatment, *Phosphates, *Iron oxides, Water pollution, Pollution abatement, Domestic wastes, *Ions.
Identifiers: Orthophosphates.

Waste water containing phosphate ion is treated with activated hydrous ferric oxide. This procedure reduces the orthophosphate ion concentration without unduly raising the pH or adding an unwanted ion to the water. (Sinha-OEIS)
W72-05041

BLOCK DRYING OF CHICKEN MANURE,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
A. T. Sobel.
Compost Science, Vol 11, No 3, 1 tab, 1970. p 28-29, 3 fig, 3 ref.

Descriptors: *Farm wastes, *Drying, *Poultry, Moisture content, Odor, Nitrogen, *Waste treatment.
Identifiers: Block drying.

Blocks of chicken manure were air dried to form a storable product with minimum odor. Reductions in weight, volume, nitrogen, and viable organisms were obtained during the drying period and following storage period. Due to moisture loss during drying, the blocks experience a weight reduction to 29 percent of the initial weight. Shrinkage can result in a volume reduction of approximately 50 percent. The reduction in viable organisms over a 3-3/4 period is substantial but a large number of organisms still exist. Nitrogen is lost during the drying and storage period. (Bundy-Iowa State)
W72-05054

HANDLING LIVESTOCK WASTE,
North Dakota State Univ., Fargo. Dept. of Agricultural Engineering and Animal Science.
G. L. Pratt, D. W. Johnson, and M. L. Buchanan.
North Dakota Farm Research, North Dakota State University Reports on Environmental Quality, Vol 4, No 28, p 22-24, March-April, 1971. 1 tab.

Descriptors: *Farm wastes, *Treatment, *Water quality control, Oxidation lagoons, Aeration, Disposal, Drying, Farm lagoons, Filtration, Dewatering, Separation techniques, Waste storage, Confinement pens, Settling basins, Runoff.
Identifiers: *Groundwater pollution, Feedlots, Slatted floors.

Congress has been developing legislation since 1948 to prevent water pollution. The Federal Water Quality Act of 1965 was the culmination of this development. The act provided that states could set water quality standards and administer them. In 1967 the North Dakota legislature adopted a comprehensive water pollution control act. These acts have necessitated research on managing and disposing of livestock wastes. The major phases of manure handling are collection, storage, treatment, and disposal. Various methods of collection, storage, treatment, and disposal are listed with their relative advantages and disadvantages. However, spreading on cropland has been the standard method to dispose of livestock manure for a long time. Research to date indicated that it is still the most practical method for preventing pollution. (Dorland-Iowa State)
W72-05057

DRYING OF POULTRY MANURE IN A CAGE--LAYER HOUSE,
Michigan State Univ., East Lansing, Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05E.
W72-05063

ODORS, GASES AND PARTICULATE MATTER FROM HIGH DENSITY POULTRY MANAGEMENT SYSTEMS AS THEY RELATE TO AIR POLLUTION,
Cornell Univ., Ithaca, N.Y. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 05B.
W72-05067

SOIL FILTRATION TO REMOVE ODORS,
Cornell Univ., Ithaca, N.Y. Dept. of Food Science.
W. E. Burnett, and N. C. Dondero.
In: Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution. Final Report, New York State Dept. of Health, Division of Air Resources, Ithaca, New York, p 71-86, April 15, 1969. 3 fig, 8 tab, 14 ref.

Descriptors: *Farm wastes, Odor, Organic compounds, Poultry, Soil, Ammonia, Hydrogen sulfide, Filtration, *Waste treatment, *Air pollution.
Identifiers: *Soil filtration, Soil columns, Liquid dilution method, Odor panel, *Odor control.

Modern, high-density poultry operations in which there are accumulations of manure cause nuisances in populated areas because of the foul odors discharged to the atmosphere by forced ventilation. The feasibility of removing poultry odors from ventilation air by soil filtration was investigated. The soil column effectively removed manure odors. Odors were removed by only 6 inches of soil under the conditions of test. The ability of the soil to remove ammonia decreased markedly as the soil dried. Soil columns remove ammonia as long as the soil remains moist. Ammonia breaks through those columns when dry. The manured soil removed more ammonia than the untreated soil. (See also W72-05067) (Bundy-Iowa State)
W72-05073

ODOR CONTROLS BY CHEMICAL TREATMENT,
Cornell Univ., Ithaca, N.Y. Dept. of Food Sciences.
W. E. Burnett, and B. Gormel.
In: Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution. Final Report, New York State Dept. of Health, Division of Air Resources, Ithaca, New York, p 87-97, April 15, 1969. 5 fig, 1 tab, 12 ref.

Descriptors: *Farm wastes, *Odor, Poultry, Ammonia, Hydrogen sulfide, Carbon dioxide, *Waste treatment, *Air pollution.
Identifiers: *Chemical treatment, Mechanical control, *Odor control.

The various methods of odor control include elimination by mechanical, physical, or chemical means, and modification, usually by chemical means. Chemical means was reviewed in an attempt to eliminate or modify poultry manure odors. The emphasis is on abatement of odor from liquid management systems. Offensive manure odors can be effectively masked by the use of an effective masking agent dispersed in Mosquito Larvae Oil in liquid poultry manure pits. Mosquito Larvae Oil appears to do an effective job in dispersing the masking agent over the surface of the liquid manure. Applications of 5 ml and 10 ml of making agent to the tanks of liquid manure were considered to be impractical because of the relatively short time these additions were effective in masking the odors, especially after the proportion of manure solids increased in the water. (See also W72-05067) (Bundy-Iowa State)
W72-05074

BIBLIOGRAPHY OF PRODUCTS DERIVED FROM AQUATIC ORGANISMS.
Coastal Plains Center for Marine Development Services, Wilmington, N.C.

Center Publication No 71-3, August 1971. 113 p.

Descriptors: *Aquatic plants, *Fish, Poultry, Mink, Swine, Ruminants, Feeds, *Water pollution control, Sewage treatment.
Identifiers: *Animal husbandry, *Fish protein.

367 REFERENCES INCLUDE INFORMATION ABOUT BOTH FOOD AND MEDICAL PRODUCTS WHICH CAN BE OBTAINED FROM AQUATIC ORGANISMS. References on direct consumption of sea products, such as fishing methods and the use of fresh fish or shellfish, are excluded. Main emphasis is on conversion of aquatic plants and animals to products such as fertilizers, food supplements for domestic animals and man, drugs, other pharmaceuticals, and aquatic organisms for water pollution control. There is a permuted title index and an author index.
W72-05086

THE REUSE OF WATER IN MANUFACTURING: AN EXPLANATORY ECONOMIC MODEL WITH DATA ANALYSIS,
New Mexico State Univ., University Park. Water Resources Research Inst.
For primary bibliographic entry see Field 03E.
W72-05093

UTILIZATION OF ALGAE CULTURE FOR PURIFICATION OF WASTES OF WOOL-WASHING INSTALLATIONS IN EXPERIMENTAL BIOLOGICAL PONDS, (IN RUSSIAN),
Akademiya Nauk URSR, Kiev. Instytut Botaniki.
H. M. Palamar-Mordvyntseva, V. V. Stupina, V. I. Kuz'myn, L. F. Palyanychka, and V. V. Kravets.
Ukr Bot Zh. 27 (4): 473-476. 1970. (Engl. summ.).
Identifiers: Algae, Biological, Chlamydomonidae, Culture, Cyanophyta, Euglenidae, Installations, Oxygen, Ponds, Protococcus, Purification, Volvoxidae, Washing, Wastes, Wool.

The data showed that when filling biological ponds with factory wastes wild flora develops (mainly Chlamydomonidae, Euglenidae, Volvoxidae and some Cyanophyta). Artificial introduction of Protococcus algae into the wastes favors a shortening of the period between the pond filling and beginning of wild flora blooming up to 17-10 days. The specific composition of algae in quantitative and qualitative respect is much richer in the ponds where algae were introduced than in those with no introduction. In the experimental bio-pond, where the algae cultures were introduced, the decrease of biological demand for oxygen for 5 days (BOD5) for 55 days amounted to 82% while in the pond without algae culture introduction 61%-decrease of BOD5 was observed for 55 days.--Copyright 1971, Biological Abstracts, Inc.
W72-05125

PHOSPHORUS REMOVAL - THE STATE OF THE ART,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
J. B. Nesbitt.
Journal Water Pollution Control Federation, Vol 41, No 5, p 701-713, May 1969. 4 fig, 4 tab, 39 ref.

Descriptors: *Phosphorus, Filtration, Ion exchange, Eutrophication, Nutrients, Waste water treatment, Biological treatment, Sewage treatment.
Identifiers: Chemical treatment.

The occurrence of phosphorus in wastewaters must be controlled to prevent (a) fluctuations in dissolved oxygen, (b) undesirable tastes and odors, (c) growth of undesirable plant life, and (d) increased organic loading on the receiving water

because of plant decay. Phosphorus may occur in wastewaters in the form of organic, complex inorganic, and soluble inorganic phosphorus. Present methods of measuring phosphorus are inadequate. Removal practices which have been studied are biological methods (conventional activated sludge), chemical treatment (ion exchange and lime, alum, or iron precipitation), and chemical-biological treatment. An analysis of all methods shows them to be feasible, but at a probable doubling of normal treatment plant costs ($0.003 to $0.09/1,000 gal (3,785 1) for phosphate removal). (Skogerboe-Colorado State)
W72-05131

WATER CONSERVATION BY RECLAMATION AND RECHARGE,
Nassau County Dept. of Public Works, N. Y.
J. A. Peters, and J. L. Rose.
Journal of the Sanitary Engineering Division, American Society of Civil Engineer's, Vol 94, No SA4, p 625-638, August 1968. 8 fig, 3 tab, 4 ref.

Descriptors: *Groundwater, *Recharge, *Water reuse, *Water reclamation, Sanitary engineering, Tertiary treatment, Carbon, Adsorption.

Nassau County, N.Y., is planning to reclaim water from effluent of its water-pollution-control plants, and inject this water into aquifers furnishing most of the public water supplies in the county. The injection will create a hydraulic barrier, preventing salt-water intrusion, and will allow increased withdrawals from existing water supply wells. The paper describes the relationship of the Nassau County program to other salt-water barrier and advanced waste treatment projects, and examines water-quality standards for recharging and process selection to meet these standards: demonstration facilities consisting of a 400-gpm renovation plant providing coagulation, filtration, and carbon adsorption, and a water injection plant with redevelopment facilities and observation wells are also described. (Skogerboe-Colorado State)
W72-05140

5E. Ultimate Disposal of Wastes

A SURVEY OF ALTERNATE METHODS FOR COOLING CONDENSER DISCHARGE WATER, TOTAL COMMUNITY CONSIDERATIONS IN THE UTILIZATION OF REJECTED HEAT,
Dynatech Corp., Cambridge, Mass.
For primary bibliographic entry see Field 05D.
W72-04830

FEEDLOT WASTE MANAGEMENT.
Missouri River Basin Animal Waste Management, Kansas City, Mo. Pilot (Steering) Task Group.

Environmental Protection Agency, June 1971. 45 p, 2 fig.

Descriptors: *Water pollution control, Confinement pens, Cattle, Pollutants, Non-structural alternatives, Path of pollutants, Water law, Legislation, Regulation, Farm wastes, Livestock, Management, Financing, Missouri River, River basins.
Identifiers: Technical assistance.

Basic information on the problem of beef cattle feedlot waste management and the pollution arising from these operations is presented in a non-technical manner. The factors that cause feedlots to pollute and the magnitude pollutants may reach are discussed along with some management factors and structural and mechanical means to help control water pollution. Sources of technical and financial assistance in design and layout of control facilities and the water pollution control agencies for the ten Missouri River Basin states are listed. Existing animal waste control regulations are also furnished for these ten states. (EPA abstract)
W72-04965

DEAD BIRD DISPOSAL BY RENDERING,
California Univ., Riverside.
W. C. Fairbank, and E. L. Bramhall.
Poultry Digest, Vol 30, No 358, p 600-601, December 1971.

Descriptors: *Farm waste, *Chickens, *Waste disposal, *By-products, Artificial use.
Identifiers: Rendering.

The reduction of dead poultry, and poultry viscera, feathers, cockerels, and unmarketable eggs to salable by-products is probably the most nearly perfect disposal method for these wastes. Rendering is a recycling process. Meat, bone, and feather meal are used in formulation of livestock and pet foods. The rendered 'yellow grease' is used mainly by feed, soap, and chemical industries. Usually no payment is made to the poultry supplier, but receptacles with tight-fitting lids are supplied. Whole carcasses are cooked and fed uniformly to a tapered screw oil expeller or press. Dead whole poultry yield 50% recovery, 25% of which is grease and 75% meal. The value of meal (about 58% crude protein and 4% crude fats) is approximately four cents per pound. The value of feed grade yellow grease is about seven cents per pound. Restaurant grease, butcher shop trimmings, and small animals can be blended to provide sufficient volumes for continuous use of the rendering plant cookers. A layer population of several million hens is necessary to supply adequate mortalities if there is no other source of compatible waste. (Schmitt-Iowa State)
W72-05055

POULTRY POLLUTION: RESEARCH RESULTS,
Michigan State Univ., East Lansing. Agricultural Experiment Station.
C. C. Sheppard.
Research Report 152 Farm Science, C.C. Sheppard, editor. 64 p. November, 1971.

Descriptors: *Farm wastes, *Odor, *Poultry, Nutrients, Diets, Fertilizer, *Waste disposal, Analysis.
Identifiers: *Dried Poultry waste, Air ventilation, Supplemental protein, Feed efficiency.

The drying and feeding of poultry waste was reviewed as to the economic value, nutrient value, and the effects on animals fed dried poultry manure. The topics include: (1) economics of dried poultry waste as a feed ingredient or a fertilizer, (2) feeding dehydrated poultry waste to dairy cows, (3) the relationship of drying temperature to total crude protein in dried poultry waste, (4) drying of poultry manure in a cage-layer house, (5) dried poultry waste as a protein source for feedlot cattle. (6) the metabolizeable energy value of dried poultry waste, and (7) the effects of continually recycling dehydrated poultry waste on the performance of SCWL laying hens. A table presents results of analyses of samples of dried poultry waste. (See also W72-05059 thru W72-05066) (Bundy-Iowa State)
W72-05058

EARLY EXPERIMENTS AT MICHIGAN STATE UNIVERSITY INVOLVING THE USE OF CHICKEN MANURE,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
H. C. Zindel.
In: Poultry Pollution: Research Results, Michigan Agricultural Experiment Station, Research Report 152 Farm Science. November 1971. p 2-3.

Descriptors: *Farm wastes, *Poultry, Nutrients, Antibiotics, Diets, *Waste disposal.
Identifiers: Fresh chicken droppings, Oven dried.

The original poultry science research at Michigan State University involving the use of poultry excreta as a feed ingredient was performed in 1954. Drs. David Libby and P. J. Schaible used poultry manure in research involving antibiotics. They reported that under clean battery conditions, no response was obtained from the drug in the feed. However, when contaminated manure was in the ration, the furazotidone exhibited a pronounced growth response. In 1959, W. K. Warden and P. J. Schaible conducted a series of experiments in which fresh chick droppings were fed to chicks daily in the presence and absence of antibiotics. When fecal matter was fed to chicks, growth rate was depressed below that of the controls, but this depression was not statistically significant. In 1961, J. D. Yates reported that fresh hen feces added to the feed of chicks and poults depressed growth, except in some groups which received a high level of antibiotics. Heated (100 Deg C) fresh hen feces improved the growth rate of chicks which received no antibiotics and turkey poults which received Virgeniamycin in the ration. (See also W72-05058) (Bundy-Iowa State)
W72-05059

ECONOMICS OF DRIED POULTRY WASTE (DPW) AS A FEED INGREDIENT OR A FERTILIZER,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
H. C. Zindel, and C. J. Flegal.
In: Poultry Pollution: Research Results, Michigan Agricultural Experiment Station, Research Report 152 Farm Science, November, 1971. p 4-7.

Descriptors: *Farm wastes, *Odor, Drying, Poultry, Fertilizer, *Waste disposal.
Identifiers: *Hens, Tractor and spreader, Dried poultry waste, Recycling.

Several laying hen trials have been conducted using dried poultry waste (DPW) in the diet. If 12.5% or 25% DPW of the total ration were substituted for the same amount of corn on a pound for pound basis, basing the cost of corn at $60 per ton and DPW at $20 per ton, a direct saving of either $5.00 or $10.00 per ton can be realized, respectively. Translating this into savings per dozen eggs, a one cent per dozen eggs savings would be accomplished for 12.5% DPW and a two cents per dozen eggs savings on 25% DPW. Manure disposal via the conventional method of spreading on crop land versus that of drying provides some interesting facts and figures. A flock of 100,000 layers provides 4,563 tons of manure per year (at the rate of .25 lb./bird/day) or 12.5 tons daily. If one assumed it takes 2 days or 16 hr. to clean the house (s) each month (4 week period) and deliver the wet manure to the field for spreading with a tractor and spreader, or deliver to a dryer site for processing, the following facts apply: wet manure value for fertilizer: $2.39 ton; cost of spreading wet manure: $11.96 tons. Difference of $9.57 /ton is the loss to spread on the land. (See also W72-05058) (Bundy-Iowa State)
W72-05060

FEEDING DEHYDRATED POULTRY WASTE TO DAIRY COWS,
Michigan State Univ., East Lansing. Dept. of Dairy Science.
J. W. Thomas, and H. C. Zindel.
In: Poulty Pollution: Research Results, Michigan Agricultural Experiment Station, Research Report 152 Farm Science, November, 1971. p 8-11, 2 tab, 4 ref.

Descriptors: *Farm wastes, *Poultry, Cattle, Drying, Amino acids, Nitrogen, Protein, *Waste disposal.
Identifiers: Laying hens, Dairy cattle, Dehydrated poultry waste, Milk quality.

Investigators have found that several classes of livestock could derive energy and nitrogen from various animal manures. The digestive system of the ruminant can convert various non-protein-nitrogen sources into amino acids that are useful to the animal. Of the nitrogen in poultry manure, 25 to 75% may be in various non-protein-nitrogen forms. This non-protein-nitrogen in poultry

manure may slowly hydrolyze in the rumen and form a very good source of N for ruminants. Dehydrated caged layer feces was fed to milking dairy cows to determine if it could serve as a nitrogen energy source. Consumption of the grain mixture containing 30% dehydrated poultry waste (DPW) was as great as that of cows fed normal grain mixtures after the cows became accustomed to the material. The flavor of the milk from DPW fed cows was scored normal. Dehydrated caged layer feces was successfully used to furnish a portion of the dietary protein and energy in the diet of milking cows. Thus, products similar to that used here could replace 15 to 20% of the dietary protein of ruminants. (See also W72-05058) (Bundy-Iowa State)
W72-05061

THE RELATIONSHIP OF DRYING TEMPERATURE TO TOTAL CRUDE PROTEIN IN DRIED POULTRY WASTE,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
C. C. Sheppard, C. J. Flegal, D. Dorn, and J. L. Dale.
In: Poultry Pollution: Research Results, Michigan Agricultural Experiment Station, Research Report 152 Farm Science, November, 1971. p 12-16, 1 fig, 2 tab, 3 ref.

Descriptors: *Farm wastes, *Drying, Protein, Poultry, Feces, *Waste disposal.
Identifiers: Dried poultry waste, Commercial dryer.

Benne from Michigan State University reported laboratory analysis of 77 samples of poultry feces. Fourteen of these were analyzed as a wet product (as received from a poultry house) and 63 had been dried in a commercial dryer, prior to the analysis. The extreme variations in total protein on a dry weight basis of the wet and dried samples are given. The relationship between the temperature at which the feces was dried and the resulting total protein content of the dried poultry waste was investigated. The regression analysis of the data shows there tends to be an inverse relationship between the heat and the resulting total protein. The correlation of drying temperature to the resulting total protein approaches significance. The calculated coefficient was -0.284; -0.288 would indicate significance at the P = .05 level. (See also W72-05058) (Bundy-Iowa State)
W72-05062

DRYING OF POULTRY MANURE IN A CAGE--LAYER HOUSE,
Michigan State Univ., East Lansing, Dept. of Agricultural Engineering.
M. L.Esmay, and C. C. Sheppard.
In: Poultry Pollution: Research Results, Michigan Agricultural Experiment Station, Research Report 152 Farm Science, November, 1971. p 17-27, 2 fig, 3 tab.

Descriptors: *Farm wastes, *Odor, *Poultry, *Drying, Environment, Air pollution, *Waste disposal.
Identifiers: Partial drying, Cage-laying house, Air ventilation.

Odor control is important for today's poultry enterprises. Partial drying of the poultry excreta within a few hours after deposit is one way to minimize odor production and thus air pollution. This investigation deals with the means and related economics of partially drying fecal matter in the poultry house with supplemental electrical energy. Over 2000 Btu of electrical energy were required to evaporate each additional pound of water from the fecal matter accumulated over the energized dropping pit panels. This is less than 50% efficient use of electrical energy applied to the floor panels below the cages. The cost was about one cent per additional pound of water evaporated from the droppings, (1 kwh equals .3420 Btu/hr and each kwh costs between 1.5 to 2.0 cents). Removing additional water from the droppings during winter months may not be worth the cost, unless the undesirable threshold is imminent and dwellings are near by. During hot weather conditions, removing part of the fecal matter moisture immediately after depositcould be critical in controlling odors. High temperatures accelerate odor production; and hot weather vaporization with energized panels could be much more efficient in utilizing electrical heat. (See also W72-05058) (Bundy-Iowa State)
W72-05063

DRIED POULTRY WASTE AS A PROTEIN SOURCE FOR FEEDLOT CATTLE,
Michigan State Univ., East Lansing. Dept. of Animal Husbandry.
H. F. Bucholtz, H. E. Henderson, C. J. Flegal, and H. C. Zindel.
In: Poultry Pollution: Research Results, Michigan Agricultural Experiment Station, Research Report 152 Farm Science, November, 1971. p 28-31, 2 tab.

Descriptors: *Farm waste, *Poultry, Drying, *Cattle, Nutrient, Protein, *Waste disposal, Efficiency.
Identifiers: Dried poultry waste, Feedlot cattle, Supplemental protein, Feed efficiency.

Waste disposal in animal agriculture has become not only a management problem, but also an environmental pollution concern to people associated with the animal industries. The poultry industry tried to dry poultry waste to abate the waste disposal problem. Due to the high protein content of fresh poultry waste (as high as 50% CP), research was conducted using dried poultry waste (DPW) as a protein supplement for chickens and cattle. However, data on recycling DPW through cattle is limited. The value of DPW as a supplemental protein source for feedlot cattle was determined. The source of protein had a large and highly significant effect on average daily gain. Average daily gain for the soy supplemented group (3.35 lb) was significantly greater than the group supplemented with DPW (2.75 lb), 1/2 DPW - 1/2 urea (3.03 lb). However, this was not significantly greater than the urea supplemented group (3.10 lb). No significant differences in average daily gain occurred between the groups supplemented with urea, 1/2 DPW - 1/2 soy or 1/2 DPW - 1/2 urea. Steers refused to consume the DPW portion of ration. (See also W72-05058) (Bundy-Iowa State)
W72-05064

THE METABOLIZEABLE ENERGY VALUE OF DRIED POULTRY WASTE,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
D. Polin, S. Varghese, M. Neff, M. Gomez, and C. J. Flegal.
In: Poultry Pollution: Michigan Agricultural Experiment Station, Research Results, Research Report 152 Farm Science, November 1971. p 32-44, 1 fig, 5 tab, 15 ref.

Descriptors: *Farm wastes, Drying, *Dehydration, Poultry, Nutrients, Nitrogen, Diets, *Waste disposal.
Identifiers: *Dried poultry waste, *Metabolizeable energy.

Metabolizeable energy (M.E.) values of 0.35 and 1.35 kcal/g (159 and 614 kcal/lb) of material were found for cellulose and a dried poultry waste (DPW) sample, respectively, when fed to laying hens. The materials were analyzed for M.E. by replacing corn in a practical type layer ration at levels of 8 and 16%. The calories returned to the diet by either DPW or cellulose were determined and compared on the basis of slope ratios to the expected loss caused by the removal of corn. Cellulose at both levels depressed protein, as well as calcium and phosphorus utilization. Protein utilization was not affected by DPW and neither DPW nor cellulose had any effect on the utilization of fat, which averaged almost 90% with all test diets. (See also W72-05058) (Bundy-Iowa State)
W72-05065

THE EFFECTS OF CONTINUALLY RECYCLING DEHYDRATED POULTRY WASTES (DPW) ON THE PERFORMANCE OF SCWL LAYING HENS -- A PRELIMINARY REPORT,
Michigan State Univ., East Lansing. Dept. of Poultry Science.
C. J. Flegal, and D. A. Dorn.
In: Poultry Pollution: Research Results, Michigan Agricultural Experiment Station, Research Report 152 Farm Science, p 45-48, November 1971. 3 tab, 2 ref.

Descriptors: *Farm wastes, Poultry, Drying, Nutrients, Diets, *Dehydration, *Waste disposal.
Identifiers: *Dried poultry waste, Dehydrated feces.

An ultimate goal in poultry production is a closed circuit system in which the only by-product of the system is meat or eggs. The following experiment was conducted to test the concept or recycling the feces within a closed system of egg production for an extended period. Five hundred and eighty-eight commercially grown 20-week-old started pullets were fed diets containing 0, 12.5%, and 25.0% DPW for about 7 mo. The DPW diets were continually recycled, i.e., feed feces dehydrated and placed back in the diets and fed to the same birds in a closed system concept. At the completion of fourteen cycles, the proximate analysis of the DPW from each of the experimental rations was quite similar. There was a trend toward a slight accumulation of calcium and phosphorus. Egg production for the birds fed the control diet and the diet containing 12.5% DPW were similar. Daily feed consumption of the birds fed the control diet and the diet containing 12.5% DPW was similar, but those birds fed the diet containing 25% DPW ate 11.3 g more feed per bird per day than those fed the control diet. (See also W72-05058) (Bundy-Iowa State)
W72-05066

5F. Water Treatment and Quality Alteration

AMOEBIC CYSTICIDAL PROPERTIES OF HALOGENS IN WATER,
Johns Hopkins Univ., Baltimore, Md. School of Hygiene and Public Health.
R. Stringer, and C. W. Kruse.
Journal of the Sanitary Engineering Division, American Society of Civil Engineers, Vol 97, No SA-6, p 801-811, December 1971. 6 fig, 27 ref.

Descriptors: *Protozoa, *Halogens, *Water treatment, Bioassay, Chlorine, Disinfection, Chlorination, Animal parasites, Methodology, Cultures, Hydrogen ion concentration.
Identifiers: *Cysticides, *Amoebic cysts, Entamoeba coli, Entamoeba histolytica, Macaca, Iodine, Inorganic chloramine, N-chloroglycine, Organic chloramine, Hypochlorous acid.

Mixtures of amoebic cysts consisting mostly of E. coli and E. histolytica isolated from the feces of naturally infected monkeys were used in experiments to determine the amoebic cysticidal properties of various concentrations of iodine, free chlorine, inorganic chloramine, and N-chloroglycine. The amoebic cysts were exposed, in duplicate, to the halogen solutions under similar conditions of cyst species, cyst density, contact time (10 min.), pH, and water temperature (30 C). Cyst concentration was accomplished by filtration of the test solution through a 0.8 micron filter. The filters were then back-washed into a 15 ml centrifuge tube, spun down and the supernatant discarded. The remaining concentrated cysts were added to an excystation medium modified with penicillin and streptomycin and cultured for at least 10 hours at 37 C. Viability counts could easily be made on cysts under high-dry magnification since viable amoebae were those which had ex-

cysted. The chemical species of free and combined halogens (iodine and chlorine) prevailing in waters with low pH were superior to those in waters of high pH. The superior cysticide was the hypochlorous acid form of free chlorine and the cysticides of lesser potency were diatomic iodine and dichloramine. The cysts from monkeys were as resistant to halogens as E. histolytica from human carriers. Graphic data are presented for all tests. (Holoman-Battelle)
W72-04746

THE HOME GROUNDWATER SUPPLY PICTURE AS WE SEE IT,
Environmental Protection Agency, Washington, D.C. Div. of Water Hygiene.
James H. McDermott.
Ground Water 9 (3): 17-23, 1971. Maps.
Identifiers: Contamination, Drinking, Geologic, Georgia, Ground, Home, Relationship.

Drinking water for more than 50 million Americans is supplied from individual wells, springs, rain-water catchments or unprotected surface-water sources. The choice of water source is usually controlled by individual economic factors, and climatic, geologic and geographic considerations. This segment of the nation's population lives in the rural and suburban areas of the USA remote from existing community water supply distribution lines. During the summer of 1969 the Bureau of Water Hygiene, Environmental Health Service conducted a systematic survey of individual water supplies in 4 counties in the State of Georgia. More than 1/3 of the water supplies sampled are potentially hazardous to the users, and there is a definite relationship of the geologic environment and type of water supply to the nature of the contamination.--Copyright 1971, Biological Abstracts, Inc.
W72-04950

HYDROGEN ISOTOPE RATIOS IN A RECYCLING SYSTEM,
Environmental Health Center, Ottawa (Ontario). Public Health Engineering Div.
For primary bibliographic entry see Field 05D.
W72-04967

TRACE ELEMENTS AND COMPOUNDS IN WATERS,
Environmental Protection Agency, Boston, Mass. Div. of Water Hygiene.
Floyd B. Taylor.
Journal of the American Water Works Association, Vol 63, No 11, Part 1, November 1971, p 728-733. 5 fig, 3 tab, 5 ref.

Descriptors: *Trace elements, *Water analysis, *Potable water, Analytical techniques, Sampling, Toxicity, Public health, Legislation, DDT, Heavy metals, Aesthetics, *Water treatment, Standards.
Identifiers: *Mercury.

Although the first Drinking Water Standards published by the United States Public Health Service in 1914 contained no chemical limits, mandatory limits had been set on 9 chemicals and recommended limits had been established for 14 more by 1962. The list of chemicals in the upcoming revision of the 1962 'Standards' will be nearly double that of the 1962 standards. Conventional water treatment practices do not noticeably reduce concentrations of trace elements and compounds in the raw water. DDT and mercury levels in drinking water have been the cause of much alarm recently, and the possibility exists that such problems will be repeated with other trace elements, some of whose existence no one is presently aware. However, the possibility also exists as in the case of fluoride ion, that drinking water may become a medium through which needed trace elements are spread with great benefit to public health. Therefore, increased research efforts are needed to establish the ultimate roles of various trace elements and to develop quick and easier and more accurate methods of detection and measuring them. (Lowry-Texas)
W72-04969

ACTION OF MINERAL WATERS ON MINERAL METABOLISM IN RUMINANTS: II. PHOSPHORUS,
H. D. Figueiras, L. I. M. Nicollier, J. Alvarez, and H. R. Camberos.
Gac Vet (Buenos Aires). 32 (239): 251-256. 1970.
Identifiers: Metabolism, Mineral, Phosphorus, Ruminants, Sheep, Sulfite, Waters.

The appearance of numerous metabolic diseases as a result of mineral deficiency is described. These may have been due to minerals, particularly sulfite, in the water which the animals drank. An experiment was carried out with 8 sheep in which the P metabolism and digestibility of P under conditions of drinking heavily salted water were determined. This type of water did not affect the normal balance of P in sheep.--Copyright 1971, Biological Abstracts, Inc.
W72-05111

UTILIZATION OF WATER HYACINTH AS AN ORGANIC MANURE WITH SPECIAL REFERENCE TO WATER-BORNE HELMINTHS,
Ministry of Agriculture, Cairo (Egypt). Veterinary Research Inst.
M. Abou-El-Fadl, S. G. Rizk, A. F. Abdel-Ghani, M. K. El-Mofty, and M. F. A. Khadr.
J Microbiol U A R. 3 (1): 27-34. 1970. Arabic summary.
Identifiers: Cestode, Composting, Eichhornia-Crassipes-M, Helminths, Hosts, Hyacinth-M, Manure, Nematode, Organic, Snail, Trematode, Water-Borne.

Examination of fresh water hyacinths (Eichhornia crassipes Schlech) and snails in the immediate vicinity of the plants has not revealed the presence of infectious stages of water-borne helminths. The water hyacinth, however, must be composted before it is utilized as organic manure.--Copyright 1971, Biological Abstracts, Inc.
W72-05115

PHOSPHORUS REMOVAL - THE STATE OF THE ART,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 05D.
W72-05131

BIOLOGICAL AND BACTERIOLOGICAL EVALUATION OF PILOT PLANT ARTIFICIAL RECHARGE EXPERIMENTS,
Prague Dept. of Water Technology (Czechoslovakia).
For primary bibliographic entry see Field 04B.
W72-05143

HYPHOMICROBIA AND THE OXIDATION OF MANGANESE IN AQUATIC ECOSYSTEMS,
Tasmania Univ., Hobart (Australia). Dept. of Botany.
For primary bibliographic entry see Field 05A.
W72-05197

FLUORIDATION: THE PAST 25 YEARS,
Stellenbosch Univ. (South Africa).
J. F. V. D. S.De Villiers.
J Dent Ass S Afr. 25 (6): 183-187. 1970.
Identifiers: Africa, Child, Eczema, Examination, Fluoridation, Grand-Rapids, Michigan, Periodic, South, Weight, Years.

An experimental water fluoridation program was carried out in Grand Rapids, Michigan, (USA) that would continue for 10 yr. Exposure of a population of 160,000 to possible short or long term dangers was not considered. The program was coupled with periodic examination of school children for whose benefit the plan was mainly evolved. It was pointed out that 1900 already had water supplies naturally containing from 0.7 to 13 ppm F2. Anti-fluoridation sentiment developed even before the program was begun. There were complaints of deleterious effects: unwanted weight gains, eczema over the entire body.--Copyright 1971, Biological Abstracts, Inc.
W72-05235

5G. Water Quality Control

STRATEGIES FOR CONTROL OF MAN-MADE EUTROPHICATION,
Committee on Public Works (U.S. Senate).
For primary bibliographic entry see Field 05D.
W72-04734

ABCS OF CULTURAL EUTROPHICATION AND ITS CONTROL. PART I--CULTURAL CHANGES,
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 05C.
W72-04769

NUTRIENT REMOVAL BY WATER-HYACINTH,
Auburn Univ., Ala.
For primary bibliographic entry see Field 05C.
W72-04776

SOLUBILITY OF BARIUM AND STRONTIUM SULFATES IN STRONG ELECTROLYTE SOLUTIONS,
Bureau of Mines, Bartlesville, Okla. Bartlesville Petroleum Research Center.
J. W. Davis, and A. G. Collins.
Environmental Science and Technology, Vol 5, No 10, p 1039-1043, October 1971. 3 fig, 2 tab, 9 ref.

Descriptors: *Water pollution control, *Sulfates, *Solubility, *Aqueous solutions, *Chemical analysis, Electrolytes, Analytical techniques, Ions, Tracers, Brines, Oil industry, Water pollution sources.
Identifiers: Barium sulfate, Strontium sulfate.

Knowledge of the solubilities of BaSO4 and SrSO4 in solutions containing NaCl, CaC12, MgC12, and NaHCO3 is needed to solve geologic and petroleum production problems. Samples of the sulfates were tagged with Na2SO4 and prepared by precipitation. The solubility was measured in various concentrations of the major solutes by use of a liquid scintillation technique to detect the SO4 in solution. The observed solubilities plotted against ionic strength of the solution are similar for strong electrolytes and reach a maximum at concentration levels beginning at ionic strength of near 1. The sulfate solubility in synthetic brines (principally NaCl) confirms the ionic strength-sulfate solubility relationships. (Woodard-USGS)
W72-04793

HYDROLOGY OF HUNGRY HORSE RESERVOIR, NORTHWESTERN MONTANA,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 04A.
W72-04821

OIL SPILL CONTAINMENT SYSTEMS.
Federal Water Quality Administration, Edison, N.J. Water Quality Lab.

Available from the National Technical Information Service as PB-206 797, $3.00 in paper copy, $0.95 in microfiche. Water Pollution Control Research Series, October, 1970. 162 p, 31 fig. FWQA Program 15080 ---10/70.

Descriptors: *Oil wastes, Accidents, *Water pollution control, Fish, Benthic fauna, Benthic flora, Recreation, Skimming, Water quality control.

Identifiers: *Oil containment systems, *Oil slicks, *Booms, *Air barriers, *Floating booms.

A wide variety of devices have been designed to prevent the spread of oil slicks over wide areas. An attempt was made to include a description of all of the various types of barriers currently in the published literature, under patent application, in the final stages of development, and those available as full scale commercial equipment today. Performance data, when documented by reliable and competent personnel, are also included. The containment systems listed may be broadly generalized into the following types: commercial floating booms, improvised booms, and air barriers. More than 50 approaches to the problem are encompassed in this report, although many more systems are possible. (Lowry-Texas)
W72-04826

GUIDELINES: BIOLOGICAL SURVEYS AT PROPOSED HEAT DISCHARGE SITES,
Pacific Northwest Water Lab., Corvallis, Oreg.
Ronald R. Garton, and Ralph D. Harkins.
Copy available from GPO Sup Doc for $1.00; microfiche from NTIS as PB-206 815, $0.95. Water Pollution Control Research Series, April 1970. 103 p, 3 fig, 10 tab, 69 ref. EPA-WQO Program 16130--04/70.

Descriptors: *Thermal pollution, *Data collection, Thermal power plants, Ecology, Sampling.
Identifiers: *Siting surveys, *Biological sampling.

A quantitative approach is presented for the biological portion of thermal discharge siting surveys and discharge monitoring. Three types of studies are covered: Type I is a very general study of the aquatic system and the pertinent lieterature; Type II is a comprehensive pre-operational study designed to supply data for management decisions on power plant siting and data to serve as baseline for possible future comparison; and Type III is a post-operational continuation of Type II to detect possible effects if a thermal discharge to a natural water body is allowed. Two methods are recommended for location of sampling stations by use of a grid system based on planned outfall design. Sample collection and handling methods and frequency of sampling are suggested for fish, macroinvertebrates, plankton, periphyton and aquatic macrophytes. Methods of data handling recommended include diversity and redundancy indices and a combination of the two into one value for a test for dispersion. A scale of importance is suggested for organisms of special value in either an economic or ecologic sense. For statistical analysis of the data, four appropriate methods are recommended and sample problems are provided to illustrate data handling and conclusions to be drawn from the tests. (EPA abstract)
W72-04828

PARTIAL SOLUTIONS--THE OUTLOOK,
Bureau of Reclamation, Washington, D.C.
For primary bibliographic entry see Field 06B.
W72-04890

FARM ANIMAL-WASTE MANAGEMENT,
Iowa Agricultural Experiment Station, Ames.
J. Ronald Miner.
Iowa Agric Home Econ Exp St Spec Rep. 67: 5-43. 1971. Illus.
Identifiers: Animal, Farm, Management, Waste.

Current practices, technology, knowledge, and research results are summarized as related to the management and disposal or use of farm animal wastes in the 13 states of the North Central Region (USA) and other cooperating states. Among alternative systems of management and treatments described, attention is given to relative effectiveness in eliminating or minimizing detrimental environmental and ecological consequences. Detailed information is included on the biology and biochemistry of waste treatments; characteristics of animal wastes, including biological, physical, and chemical properties; aerobic, anaerobic, and combined treatments of animal wastes; composting, incineration, dehydration, and hydroponics; and actual and potential productive utilization of animal wastes. Needs for additional research are suggested.--Copyright 1971, Biological Abstracts, Inc.
W72-04908

THE EFFECTS OF COLUMN HEIGHT AND DIAMETER ON THE EFFECTIVENESS OF A CONTINUOUS BUBBLE FRACTIONATION SYSTEM,
Rutgers - The State Univ., New Brunswick, N.J.
Bong T. Kown.
Water Res. 5 (3): 93-102. 1971. Illus.
Identifiers: Bubble, Column, Control, Diameter, Fractionation, Height, Pollution, System.

Continuous bubble fractionation (a potential method for controlling water pollution), a separation technique based on the enrichment of a solute on the surfaces of rising gas bubbles and subsequent removal of the concentrated liquid from the top where the bursting bubbles accumulate the solute, was investigated for the separation of a solute from a dilute solution. The solute concentration profile and effectiveness of the column were studied using the height and diameter as variables. The implication of basic mechanisms involved in the solute transfer on the column performance were considered.--Copyright 1971, Biological Abstracts, Inc.
W72-04921

THE IMPORTANCE OF ECOLOGICAL STUDIES AS A BASIS FOR LAND-USE PLANNING,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 06B.
W72-04936

ENVIRONMENTAL POLICY IN A HYPERTROPHIC SOCIETY,
Indiana Univ., Bloomington. Dept. of Political Science.
For primary bibliographic entry see Field 06B.
W72-04938

FEEDLOT WASTE MANAGEMENT.
Missouri River Basin Animal Waste Management, Kansas City, Mo. Pilot (Steering) Task Group.
For primary bibliographic entry see Field 05E.
W72-04965

ENVIRONMENTAL POLICY AND POLITICS: VALUE AND POWER CONTEXT,
New Mexico Univ., Albuquerque. Program for Advanced Study in Public Science Policy and Administration.
For primary bibliographic entry see Field 06B.
W72-04985

INDUSTRIAL SPILL CONTROL AND POLLUTION INCIDENT PREVENTION,
Proctor and Gamble Co., Cincinnati, Ohio. Environmental Control Section.
G. N. McDermott.
Journal Water Pollution Control Federation, Vol 43, No 8, August 1971, p 1629-1639. 9 fig.

Descriptors: *Accidents, *Hazards, *Public health, Fishkill, Industrial wastes, Pipes, Pumping, Condensation, Storm runoff, Storm drains, Water pollution control.
Identifiers: *Spills, *Containment systems, Loading and unloading, Curbs.

More than half the major fish kills in recent years have resulted, not from lack of, or malfunctions within, treatment plants, but from accidental spills of industrial liquids. Typical of such accidents are leaks or ruptures of a tank or pipeline, over-filling of a tank, and failure of a valve or fitting, loading or unloading mishaps, leaks in heat exchangers to once-through cooling waters and carry over in evaporators to spray condensers. The most troublesome spills are those which flow directly, or through storm sewers, to natural water courses. Curbs around tank farms and unloading areas with outlets to either a storage basin, the sanitary sewer or the storm sewer system should be provided to achieve positive control over all runoff from such areas. In-plant systems should be designed to enable leaks, pump gland cooling liquids, condensate from heating coils, and washups to be directed to the process waste or sanitary sewer systems. Various schemes for inclusion in newer plants and modification of existing plants are presented. (Lowry-Texas)
W72-05017

THE ENVIRONMENTAL MOVEMENT: AMBIGUITIES AND MEANINGS,
California Univ., Santa Cruz.
For primary bibliographic entry see Field 06B.
W72-05021

POLITICAL AND SOCIAL ACCOMMODATION: THE POLITICAL PROCESS AND ENVIRONMENTAL PRESERVATION,
Colorado State Univ., Fort Collins.
For primary bibliographic entry see Field 06E.
W72-05083

NUCLEAR ENERGY FOR A NEW TOWN,
Rhode Island Univ., Kingston. Water Resources Center.
For primary bibliographic entry see Field 06G.
W72-05091

THE MILL RIVER AND ITS FLOODPLAIN IN NORTHAMPTON AND WILLIAMSBURG, MASS.: A STUDY OF THE VASCULAR PLANT FLORA, VEGETATION, AND THE PRESENCE OF THE BACTERIAL FAMILY PSEUDOMONA--DACEAE IN RELATION TO PATTERNS OF LAND US E,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 05C.
W72-05092

WHERE WILL ALL THE PEOPLE GO. HOW MUCH WILL THEY DUMP WHEN THEY GET THERE -- POPULATION DISTRIBUTION, ENVIRONMENTAL DAMAGE, AND THE QUALITY OF LIFE,
RAND Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 06B.
W72-05123

COST OF RECLAMATION AND MINE DRAINAGE ABATEMENT-ELKINS DEMONSTRATION PROJECT,
Environmental Protection Agency, Cincinnati, Ohio. Water Quality Office.
R. B. Scott, R. D. Hill, and R. C. Wilmoth.
Available from the National Technical Information Service as PB-207 189, $3.00 in paper copy, $0.95 in microfiche. Robert A. Taft Water Research Center Report, Environmental Protection Agency, 1970. 27 p, 1 fig, 11 tab, 7 ref. (Revision of Paper 70-AG-349 presented at Soc of Mining Engineers Meeting, Oct 21-23, 1970, St. Louis, Mo) EPA Program 14010--10/70.

Descriptors: *Water pollution control, *Acid mine water, *Coal mines, *Land reclamation, *West Virginia, Revegetation, Costs, Reviews.
Identifiers: Mine drainage abatement, *Elkins (W Va).

Acid mine drainage, discharging from coal beds, pollutes streams and rivers. These pollutants affect water quality by lowering the pH, reducing natural alkalinity, increasing total hardness, and

adding undesirable amounts of iron, manganese, aluminum and sulfates. An acid mine drainage reclamation project was established in the Roaring Creek-Grassy Run watershed near Elkins, West Virginia. During the reclamation, 651 acres of surface mines were reclaimed, 709 acres revegetated, 55 masonry seals constructed, and 41 clay seals installed. The average overall surface mine reclamation cost was $2236/acre including $330/acre for clearing and grubbing, $1658/acre for reclamation, and $248/acre for revegetation. Overall cost for masonry seals was $4,138 each and clay seals $1,479. Stability of the reclaimed area has been exceptional as only eight small subsidence holes have occurred since 1967. Total maintenance costs have been less than $2,000 in three years; less than 0.03 percent per year of the construction cost. (Woodard-USGS)
W72-05146

DECONTAMINATION OF RADIOACTIVELY POISONED WATER WITH PEAT FILTERS, (IN GERMAN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
Maria Magdolna Bezzegh-Galantai.
Schweiz Z Hydrol. 32 (1): 226-270. 1970. Illus. English summary.
Identifiers: Breakthrough, Calcium, Capacity, Cation, Column, Decontamination, Deep, Exchange, Filters, Freezing, Iodine-131, Ion, Peat, Poisoned, Radioactively, Retained, Strontium-90, Switzerland, Yttrium-90.

The decontamination of rain and model water containing 90Sr-90Y, 131I by various peats was studied. The chemical composition of the model water was similar to collected rain cistern water. Peat samples were taken in the Jura mountains of Switzerland. Percolation experiments to determine the decontamination capacity of 3 types of peat were performed on ion exchange columns and in pilot installations. Good decontamination effects were determined for 90Sr-90Y. The main parameters influencing the breakthrough capacity were type of peat, degree of drying and of deep freezing. Other factors particularly those regarding exchange capacity are also significant. A measurable retention of anionically available 131I was observed only at low concentrations (<10-9 M NaI/l). Retention increases exponentially with increasing dilution ratios. A solution of <10-12 M Na 131I/l had a retained activity of 60-90%, related to the inflowing solution. Useful findings regarding soil science, particularly the irreversible structure changes of peat due to deep freezing and drying, and the correlation between Ca content or degree of decomposition and exchange or breakthrough capacity for cations are discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-05224

ESTABLISHING HYGIENIC STANDARDS FOR THE NEW COMBINED ANTI-MONOCOT HERBICIDE 50/30 CELATOX IN INLAND WATERS,
For primary bibliographic entry see Field 05C.
W72-05248

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

COMMUNITY DECISION BEHAVIOR: THE CULTURE OF PLANNING,
Boston Coll., Chestnut Hill, Mass.
R. S. Bolan.
Journal of the American Institute of Planners, Vol 35, No 5, September 1969, p 301-310. 5 fig, 35 ref.

Descriptors: *Decision making, *Planning, *City planning, Analytic techniques, Management, Optimization, Economic justification, Leadership, Political aspects, Education.
Identifiers: *Community decision behavior, Planning process, Decision making process, Abstract welfare function, Authority.

This paper sets forth a conceptual framework for better understanding the relationships between the planning process and community decision-making. From an initial assumption concerning the nature of the decision-making process, the paper suggests four sets of independent variables that affect decision outcomes: 1) process roles (including the dimensions of specialization and skill); 2) the decision field (including the environment for decision not only in the community but within the deciding body itself); (3) planning and action strategies; and 4) issue attributes. Using this framework, a series of hypotheses are posed for future research, and the potential implications for urban planning are discussed. The framework suggests very strongly the delicate nature of the relationship and balance between the substance and process of planning. It reinforces the notion that one cannot be emphasized at the expense of the other. Also, it is suggested that current concepts of optimality, the focus on an abstract welfare function, and the concern for an illusory greater good (or public interest) need to be seriously questioned. The conceptual scheme strongly suggests traditional notions of position and power as bases of authority and leadership cannot be divorced from less formal mechanisms for legitimating authority and exercising power. Finally, the conceptual framework seems to suggest training orientations in the education of planners quite different from those found in the traditional city planning curriculum.
W72-04760

SPACE-TIME SAMPLING OF ECOLOGICAL SYSTEMS,
Arizona Univ., Tucson.
H. K. Qashu, L. Duckstein, and C. C. Kisiel.
Paper presented at 40th National Meeting of OHSA, Anaheim, California, October 1971. 12 p, 3 fig, 1 tab, 9 ref.

Descriptors: Eutrophication, *Colorado River, *Estimating, *Forecasting, *Sampling, *On-site data collections, Probability, Statistical methods, Time series analysis, *Model studies, Monitoring.
Identifiers: Bayesian Decision Theory, Lake Mead.

The goals were to present a conceptual model of an aquatic system (Lake Mead-Colorado River), list some managerial goals and needed decisions, and suggest a methodology which might serve as a useful guideline for sampling ecosystems. Lake Mead was monitored for the purpose of averting eutrophication. The specific reason for this was to decide whether or not there was a need for altering dam-release policy and terminating loading of nutrients. Several sampling schemes were discussed with particular concern regarding large spatial variability where the sampling of the variable must yield needed information for identifying space and time variability. The goals of this sampling was to determine the further carrying capacity of the lake. In order to describe eutrophication in a systematic way, a time invariant linear model was chosen as a first approximation. A more realistic model, a time-varying model, was also considered. A statistical experimental design was proposed as the first step to reduce data gathered. Next a compromise was found between the study of seasonal fluctuations and the rate of plant or species growth. Bayesian decision theory was suggested as a method of describing the ecological process. (Ligon-Cornell)
W72-04779

PUBLIC PARTICIPATION AND ENVIRONMENTAL QUALITY,
Montana Univ., Missoula.
Arnold W. Bolle.
Natural Resources Journal, Vol 11, No 3, July 1971, p 497-506. 14 ref.

Descriptors: *Environmental quality, *Decision making, *Management, *Administration, Government, Formulation, Programs, Political aspects, Planning, Legal aspects.
Identifiers: *Public participation, *Resource management, Governmental agencies, Natural resource agencies, Environmental crisis, Goal determination, Litigation, Public conflict.

The environmental crisis has established the need for a new set of relationships between the public and governmental agencies, particularly the need for effective public participation within the decision process of natural resource agencies. The decision process, which is fundamental to policy and program formulation, consists of several steps: problem identification, goal determination, identification and analysis of alternatives, decision, action, and feedback and reanalysis. There is only one real basis for participation and that is full participation at all steps of the decision process. Systematic, situational resource management requires greater levels of knowledge on the part of field administrators. It requires a new structure and philosophy of operation of the agency. The field administrator must have and develop the freedom to invite and require effective public participation in goal establishment and problem identification and solution. They are necessary ingredients to the achievement of public agency contributions to environmental quality. Effective participation is essential by all affected publics if policy is to be determined without litigation, challenged administration fiat, public confrontations, or the continuous processes of public conflict with agency determinations that have dominated the arena in which resource managers have found themselves operating. The initiative for change, however, still lies with the agencies.
W72-04839

PROBLEMS RAISED BY THE APPLICATION OF STOCHASTIC RELATIONS TO HYDROLOGIC VARIABLES AND MEANS OF THEIR SOLUTION (PROBLEMES SOULEVES PAR L' APPLICATION DES RELATIONS STOCHASTIQUES AUX VARIABLES HYDROLOGIQUES ET MOYENS DE LES RESOUDRE),
Grenoble Univ. (France). Laboratoires de Mecanique des Fluides.
For primary bibliographic entry see Field 02A.
W72-04847

AGRICULTURAL FLOOD DAMAGE ASSESSMENT: A REVIEW AND INVESTIGATION OF A SIMULATION METHOD,
Toronto Univ. (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 06F.
W72-04877

EVALUATION OF RADAR AND RAINGAGE SYSTEMS FOR FLOOD FORECASTING,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 02B.
W72-04966

ALGEBRAIC TECHNOLOGICAL FUNCTION FROM A SIMULATION MODEL,
Harvard Univ., Cambridge, Mass. Center for Population Studies.
T. Maddock, III.
Water Resources Research, Vol 8, No 1, p 129-134, February 1972. 2 fig, 2 tab, 8 ref.

Descriptors: *Simulation analysis, *Systems analysis, *Optimization, *Economics, *Water costs, Cost-benefit analysis, Water management (Applied), Irrigation water, Parametric hydrology, Mathematical models.

Distributed-parameter models for groundwater simulation are difficult to couple explicitly with

management models that seek to optimize an economic objective. For a groundwater system whose drawdown in response to pumping was modeled by a two-dimensional linear partial differential equation, an algebraic technological function was produced that related seasonal pumping at wells in the system to drawdown at those wells. The algebraic technological function allows explicit coupling of the groundwater model with a quadratic programing management model. (K-napp-USGS)
W72-05034

INFORMATION REQUIREMENT FOR SOCIO--ECOLOGICAL MODELS,
Hawaii State Dept. of Planning and Economic Development, Honolulu.
Y. P. Joun.
The Annals of Regional Science, Vol. 5, No. 1, p 25-32, June 1971. 1 fig, 11 ref.

Descriptors: *Ecology, *Environmental effects, *Costs, *Model studies, Economics, Mathematical models, Input-output analysis, Data collections, Statistics, Theoretical analysis, Quality control.
Identifiers: *Information requirement, *Socio-ecological models, *Social costs, *Quantification, Social indicators, Adequate data base, Data requirements, Models, Quality of life.

Recent studies about ecological and environmental problems, as contrasted to previous ones, have attempted to quantify the non-market variables such as pollution, and to assess the social cost of the externalities. These attempts to quantify social costs are classified into three categories: 1) quantification of the 'quality of life' and monitoring of changes by 'social indicators', 2) introduction of nonmarket variables in the inter-industry; ecological models and study of the environmental repercussions of economic growth; or proposals to build a social accounting system, describing ecological chains, and 3) construction of mathematical models which show the consequence of rapidly rising population on society and natural environment. The information requirements for these various socio-ecological models are identified and the development of a coherent information system on environment is proposed. The construction of social indicators, the application of an input-output model, and the model of society are discussed. It is apparent that there is an enormous gap between the need for the data on the 'quality of life' and the actual supply of such data. Previous arguments have stated that any model building effort in the area of ecological systems must wait until an adequate data base is established. The identification of data requirements for the construction of such models points out the characteristics of statistical information system that should be established. The construction and interpretation of social indicators requires more theoretical analysis. Extensive theoretical and empirical work on sub-models must precede any attempt to build a truly comprehensive socio-ecological model. (Strachan-Chicago)
W72-05119

6B. Evaluation Process

THE SOCIAL CONTEXT OF URBAN PLANNING,
M. Broady.
Urban Affairs Quarterly, Vol 4, No 3, p 355-378, March 1969. 65 ref.

Descriptors: *City planning, *Social aspects, *Urban sociology, *Decision making, Economics, Land use, Behavior, Flexibility.
Identifiers: *Social context, *Urban planning, *Sociology, *Policy making, *Theoretical depth, *Factual content, *Approach, Land design, Indeterminancy.

A viable sociology of planning needs theoretical depth as well as factual content. The major intellectual reason for the odd relationship between planning and sociology is that there has been too much simple fact-finding and too little theoretical argument. The methods of a theoretical approach to the sociology of planning make possible the founding of certain kinds of planning decisions more validly upon evidence and clearly stated assumptions, and permit a greater control of policy by the regular review of forecasts in the light of actual, ongoing experience. Planning is viewed primarily as a matter of physical design and land use. More recently, the relationship between planning and economics has begun to be considered. There has been some recognition of the social aspects of planning also. Social behavior does not permit the social scientist to claim the same assurance for his predictions as the physical scientist. Social behavior is inevitably indeterminate. This view of the indeterminancy of social behavior changes the role of the individual in planning. The planner must allow for the behavior of the individual. The importance of associating human resources with physical and economic development is being accepted and a practice of doing so being worked out. The recognition of the indeterminancy of social behavior has produced a degree of flexibility in the planning process. The practical development of these ideas is hampered by the perspective which connects planning only with land use and economics. (Strachan-Chicago)
W72-04758

POPULATION GROWTH IN COMMUNITIES IN RELATION TO WATER RESOURCES POLICY.
Rivkin/Carson, Inc., Washington, D.C.

Available from the National Technical Information Service as PB-205 248, $3.00 in paper copy, $0.95 in microfiche. National Water Commission report no. SBS-71-024, October 1971, 191 p. 9 fig, 43 tab, 2 append. NWC 71-016.

Descriptors: *Area redevelopment, Census, *City planning, *Community development, Density, Dispersion, *Distributional patterns, Economics, Growth rates, Human population, Local government, Metropolitan studies, Migration, Rural areas, Social aspects, Social impact, Urban areas, Urbanization, Water distribution (Applied), Water distribution (Policy), Water policy, Water resources development, Water supply.
Identifiers: *Geographic distribution of population, *Growth centers, *New towns, *Population dispersal, Population distribution policy, Rural urban migration, Small cities and towns.

Pattern of population growth in U.S. communities over the past two decades is examined in detail, with particular reference to the influence of water and water resources development on these patterns. Also reviews the experience of two types of Federal programs: those concerning local water, sewer and allied facilities; and those directed towards stimulating economic and population growth in less developed areas. Examines American experience with new communities and new approaches to community land development. Reviews present thinking on the establishment of national policies for urban growth and population distribution. (NWC)
W72-04785

ADMINISTRATIVE ALLOCATION OF WATER,
National Water Commission, Arlington, Va.
For primary bibliographic entry see Field 06E.
W72-04786

HYDROMETEOROLOGY IN PRECIPITATION MANAGEMENT,
Bureau of Reclamation, Denver, Colo.
P. A. Hurley, and O. H. Foehner.
Paper, American Society of Civil Engineers, Hydraulics Division Special Conference, University of Iowa, Iowa City, Aug 1971. 15 p, 6 photo, 14 ref, append.

Descriptors: *Precipitation (Atmospheric), Water resources management, Planning, Water resources development, *Weather modification, *Cloud seeding, Control, Floods, Runoff forecasting, Snow gages, Snowmelt, Snowpacks, Soil erosion, Watershed management, Avalanches, Environmental effects, *Evaluation, Anemometers.
Identifiers: *Colorado River Pilot Project, Colorado River Basin, Operational hydrology, *Hydrometeorology.

Hydrometeorology fulfills several broad roles in precipitation management. Estimating effects of modification during planning, cloud seeding control and administration during operations or experiments, and the evaluation of seeding program results are some of the hydrometeorological aspects of weather modification discussed. Developments in precipitation modification and water resource planning have progressed to the point where they can no longer be considered independently. Precipitation modification is now practical on a significant scale. The Bureau of Reclamation's Colorado River Basin Pilot Project is an example of planning application. Some hydroeteorological factors considered in choosing the target area are presented. The operational use of weather modification on a large scale raises difficult questions about legal responsibilities, conflicting social desires, and appropriate governmental regulatory activities. Hydrometeorology will supply the factual basis for decisionmaking in each problem area. Historically, evaluation of the effects of weather modification has been the weak link between the weather modifier and the public. Statistical techniques used to establish the change in precipitation are described. (USBR)
W72-04866

WATER AND WESTERN DESTINY: FROM CONFLICT TO COOPERATION.
Colorado State Univ., Fort Collins. Environmental Resources Center.

Proceedings of the Third Western Interstate Water Conference, Fort Collins, Colorado, Norman A. Evans, Editor, 1969. 78 p.

Descriptors: *Water policy, *Water utilization, *Planning, *Water management (Applied), *Water demand, Water resources development, Political aspects, Social aspects, Environmental effects, Evaluation.
Identifiers: *Western US water development.

The Third Conference provided discussion of current, important water planning issues where cooperation is urgently needed. The stage was set early in the Conference by a review of current water resource planning processes in the western region, and steps were suggested for their improvement. Executive officers of the National Water Commission, the Western States Water Council, and the federal Water Resources Council reported recent advances made by these agencies. Representatives with interests in various water uses, including irrigation, wildlife, and conservation, dealt with the question of establishing acceptable values for different water uses; views of thoughtful citizens were also represented. Alternatives for obtaining a water supply in water-shortage areas were discussed, emphasizing the critical social, economic, and political issues. And finally, methods of water management were examined by representatives interested in the principal competing uses: irrigation, waste disposal, municipal and industrial water and recreation. (See also W72-04879 thru W72-04895).
W72-04878

THE FUTURE OF WESTERN WATER DEVELOPMENT,
California Univ., Los Angeles.
E. A. Engelbert.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 1-3.

Descriptors: *Water resources development, *Water policy, Planning, Political aspects, Social impact, Environmental effects.
Identifiers: *Western US water development, Urban problems.

In 1965, the future of Western water development seemed relatively rosy. By the end of the sixties, however, the picture was considerably different. The nation is undergoing a period of political and social change, and the associated reassessment and reordering of national priorities has caused proposed schemes of water development to be measured, relative to other national needs, in a less favorable context. Consequently, many authorized projects have yet to be funded. Several factors have helped to reshape the political and social climate of Western water development: (1) the West is no longer perceived by the rest of the nation as an underdeveloped frontier region whose conomy needs to be bolstered by massive expenditures for water resources development programs; (2) the importance of resource development is being overshadowed by the problems of our cities; (3) the public's growing concern over environmental damage has made projects appear less desirable; (4) emphasis has shifted from development to improvement of water already available; and (5) many project plans are very complex and, thus, difficult to implement. To rebuild public support, development projects must be presented in a human-behavioral, urban-oriented setting in contrast to a resource-oriented agricultural setting. (See also W72-04878) (Settle-Wisconsin)
W72-04879

WATER RESOURCES DEVELOPMENT,
Montana State Univ., Bozeman.
R. E. Huffman.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 6-9.

Descriptors: *Water resources development, *Water transfer, *Water demand, *Water supply, Economic efficiency, Evaluation, Population.
Identifiers: Engineering efficiency.

The analysis of water resources development projects requires a broad evaluation framework, particularly when projects with regional or national implications are considered. The narrow, technical view of the engineer and the efficiency-oriented view of the economist are necessary but certainly not sufficient for an adequate evaluation of development projects. Analyses of future projects should seek answers not only to technical and cost-benefit questions, but also to questions such as the following. In lieu of regional transfers, should agricultural and industrial water uses be curtailed in order to meet increases in domestic and municipal demands. Should needy areas be required to prove how efficiently they utilize current water supplies before regional transfers are undertaken. Should water policy be used to discourage population concentrations. Answers to questions such as these could suggest that social costs can be reduced by reformulating water policy so as to encourage more efficient use of existing supplies and more intensive use of currently underutilized supplies. (Settle-Wisconsin)
W72-04880

MAKING WATER RESOURCES PLANNING RELEVANT,
Federation of Rocky Mountain States, Inc., Denver, Colo.
J. Campbell.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 10-11.

Descriptors: *Water resources development, *Long-term planning, *Political constraints, Social impact, Water users, Future planning (Projected).

To help make planning for future development and use of Western water resources more than an exercise in futility, several essential approaches should be followed. First, planning must be built around man. Focusing only on the physical aspects of a project is no longer sufficient for effective planning. Second, future planning must be bold and innovative. Proper water resources planning will not respond to conventional political approaches, at least in time to avoid catastrophe. Consequently, we must be prepared to experiment with new methodology, new kinds of structures, new priorities, and greater people participation. Third, planning must be comprehensive. A city or a county or even a state cannot plan effectively in a capsule. Planning needs to be undertaken with full cooperation of other jurisdictions. Finally, plans must be made for the purpose of implementation. That is, plans must be relevant, practical, and acceptable or salable to the public. In particular, long-term plans need some short-term elements; otherwise, those plans will not be relevant to the present-day decision-makers, and will not be politically attractive. (See also W72-04878) (Settle-Wisconsin)
W72-04881

A NEW LOOK AT NATIONAL WATER POLICY,
National Water Commission, Arlington, Va.
T. M. Schad.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 12-17.

Descriptors: *Water resources development, *Water policy, *Evolution, Long-term planning, Water requirements, Water allocation (Policy), Social impact, Economic impact.
Identifiers: *National Water Commission.

The National Water Commission, created by Congress in September, 1968, has embarked on a five-year study of water resources and related problems leading to policy recommendations to the President and the Congress. The Congressional authorization directs the Commission to review present and anticipated national water resource problems, making projections of water requirements and identifying alternative ways of meeting these requirements. The Commission is to consider the economic and social consequences of water resource development, including the impact of such development on regional economic growth, on institutional arrangments, and on aesthetic values. In order to accomplish these tasks, and to provide the background for its reports and recommendations, the National Water Commission will undertake a program of special studies dealing with all aspects of the care and development of water and related land resources. The work will be done by the National Water Commission staff, by consultant advisers, by other government agencies under agreement with the Commission, and by universities and other groups having specialized competence. A tentative program of studies under consideration by the National Water Commission' accompanies the paper. (See also W72-04878) (Settle-Wisconsin)
W72-04882

A REVIEW OF INTER-REGIONAL AND INTERNATIONAL WATER TRANSFER PROPOSALS,
Western States Water Council, Portland, Oreg.
J. R. Bingham.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 18-24. 2 tab, 20 ref.

Descriptors: *Water transfer, *Reviews, *Planning, Estimated costs, Volume.

Twenty-three water transfer proposals are briefly reviewed. The interregional transfer proposals reviewed are Alberta, Canada's PRIME Plan, Mexico's Mexican Plan, Connor's Undersea Hose proposal, Udall's Pacific Southwest Water Plan, Nelson's Snake-Colorado Project, Pirkey's Western Water Project, Miller's Sierra-Cascade Project, Stetson's Yellowstone-Snake-Green Plan, Dunn's Modified Snake-Colorado Project, the Beck Plan, the National Engineering Science Company's Undersea Coastal Aqueduct proposal, the Bureau of Reclamation's West Texas and Eastern New Mexico Import proposal, and the Bureau's United Western plan. The international transfer proposals considered are Kieran's Grand Canal Plan, Decker's Great Lakes-Pacific Waterways Plan, Parsons' North American Water and Power Alliance proposal, Magnusson's Magnum Canal Concept, Alberty's Stabilization of the Great Lakes proposal, Kuiper's Canadian Water Export plan, Tinney's Central North American Water Project, Parsons' U.S. Hydroelectric Commission proposal, and Smith's Western States Water Augmentation Concept. The one global water transfer proposal reviewed is Tucker's Water for Survival plan. These proposals differ greatly in size and cost. Proposed diversions range from 1.2 million acre-feet for Udall's plan to 418 million acre-feet for Tucker's worldwide scheme. Estimated costs range from 400 million dollars for Stetson's plan to 100 billion dollars for Parsons' proposal. (See also W72-04878) (Settle-Wisconsin)
W72-04883

A LOOK AHEAD IN PLANNING COORDINATION AND POLICY MAKING,
Water Resources Council, Washington, D.C.
H. P. Caulfield.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 25-29. 3 ref.

Descriptors: *Planning, *Coordination, *Water resources development, Political constraints, Economic efficiency, Environmental effects, Social impact.
Identifiers: *Policy making, Objectives.

Optimal future development of water resources calls for certain changes in the development-related functions of planning, coordination, and policy making. Planning needs to be based on the wants of the public, not on the technician's view of what the public wants. In the past, not enough attention has been paid to the development of techniques for improving public participation. The techniques of public participation that need improvement are those which will enable the technician to ascertain the several meaningful choices that are real from the public's point of view within a region. Also important for the future of planning is economic analysis, both from national and regional viewpoints. Analysis based solely on engineering-hydrologic data is no longer feasible. In the area of coordination, the federal-state governmental relationships are and will be important. In response to a need for better coordination of activities, federal-interstate compact commissions may become commonplace. Coordination problems will also warrant a continuing review of federal organization. With regard to policy, four national objectives will be important: national efficiency, regional development, quality of the environment, and the public's well being. (See also W72-04878) (Settle-Wisconsin)
W72-04884

WATER RESOURCES PLANNING,
National Wildlife Federation, Washington, D.C.
T. L. Kimball.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 30-32.

Descriptors: *Water resources development, *Environmental effects, *Costs, Planning, Economic efficiency, Tangible benefits, Intangible benefits.

Every use of the environment entails a cost. These costs can be borne in one of three ways: (1) by paying for resources as they are used, (2) by passing the costs on to succeeding generation, or (3) by assessing the costs against the environment, a process which could conceivably result in major reductions in our standard of living. To insure that these costs are given appropriate consideration, adequate plans need to be made for every use of the environment and, in particular, water resources. In fact, planning for the suitable management and development of water resources is essential to our future well-being. While these costs are important, economic evaluations should not constitute the only criteria for decision making. Such intangibles as the beauty of a stream surely must take precedence over purely monetary considerations. To improve the planning and decision making process, a modernization of the complicated system relating to water resources development might be in order. For instance, there appears to be some merit to the consolidation of all the Federal water resource construction agencies. (See also W72-04878) (Settle-Wisconsin)
W72-04885

THE THIRD WESTERN INTERSTATE WATER CONFERENCE OF COLORADO STATE UNIVERSITY,
National Water Resources Association, Washington, D.C.
C. Bronn.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 33-40.

Descriptors: *Water resources development, *Planning, *Cost-benefit analysis, *Water values, Decision making, Evaluation, Project benefits, Project feasibility.

An evaluation of benefits arising from water resources development projects should include (1) direct benefits from the project, and (2) benefits toward national objectives, such as well-being, health, jobs, or training. Thus, a knowledge of national objectives and their priority, and of how water and related land proposals can serve them, should be applied when formulating proposals to conserve resources. The relative priorities of national objectives can be assessed from Budget trends, Administration proposals, and Congressional views. On this basis, it seems that programs designed to serve concentrations of people are likely to be funded, while resource-oriented programs are not. In some instances the actual evaluation of benefits may be undertaken by valuing water uses at the cost of the best alternative. Disadvantages to this approach include the following: (1) surplus benefits may not be counted, and (2) the benefits of projects toward achieving national objectives are not included. Other project evaluation techniques are available. Value could be estimated to be (1) the cost of the latest increment of water developed by the community, or (2) the maximum reimbursement a Federal negotiator could extract. Of course, a project might be deemed sound simply because it furthers a national objective. (See also W72-04878) (Settle-Wisconsin)
W72-04886

THE PRIMACY OF OUR ENVIRONMENT OVER THE ECONOMY,
Sierra Club, Albuquerque, N. Mex.
J. Ingram, and H. A. Ruckel.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 41-44.

Descriptors: *Water resources development, *Long-term planning, *Human population, Stabilization, Environmental effects, Economic impact, *Political constraints, Decision making.
Identifiers: *Goals.

In the past the major orientation of water development has been to encourage the growth of our economies and settlements. Different goals will achieve primacy in the near future, however. These goals will include (1) restriction and maintenance of the environment; (2) stabilization of our population; (3) maintenance of a prosperous, stable economy; and (4) improvements in the poors' relative standard of living. Several tools or concepts that may prove helpful in our quest for these goals are environmental benefit-cost ratios, projection of alternative futures, national resource pools, and natural processes versus man-directed ones. To integrate these concepts into a planning framework, Congress will first have to define goals that meet peoples' needs. Next, public and private agencies would formulate and describe alternatives. Third, these alternatives and their possible effects on the environment would need to be evaluated. Finally, the alternatives' ability to produce the prosperity projected by alternative futures given the permitted level of resource consumption should be assessed. The last three steps would be in the form of presentations to Congress so that the decisions would be reached in the national political arena. (See also W72-04878) (Settle-Wisconsin)
W72-04887

IMPROVING THE PLANNING PROCESS--ESTABLISHING VALUES,
League of Women Voters, Washington, D.C.
D. E. Clusen.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 45-47.

Descriptors: *Water resources development, *Long-term planning, *Project planning, *Evaluation, Cost-benefit analysis, Decision making, Environmental effects.
Identifiers: *Public participation.

Until recently our national interest was centered on irrigation, navigation, flood control, and economic benefits. Today, however, the national concern is much wider, encompassing the pleasures and beauties of the total environment, its use for recreation, its value for preservation, and the need to protect and enhance the quality of that environment. In keeping with this broader concern, the following characteristics of good planning need to be incorporated into the water resources decision making process. First, greater attention should be paid to generating public interest and allowing the public a voice in the evaluation of alternatives. Second, ample information needs to be provided to the public about practical alternatives. Third, the demands which all parts of the public body place upon specific uses of water resources need to be evaluated. Fourth, an attempt should be made in all planning endeavors to maintain flexibility for the future. Finally, all concerned parties, both governmental and private, should be encouraged to contribute to the planning and development of water resources. (See also W72-04878) (Settle-Wisconsin)
W72-04888

SOME SOCIAL ISSUES AND ALTERNATIVES INVOLVED IN PLANNING WATER RESOURCES WITH PEOPLE IN THE WEST,
Utah State Univ., Logan. Dept. of Sociology.
W. H. Andrews.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 48-53. 12 ref.

Descriptors: *Water resources development, *Project benefits, *Population, Environmental effects, Social impact, Evaluation.

Many of our current social problems have arisen from population growth and its concentration in fast-growing, run-down, inefficient cities from which the more affluent residents have fled. Any attempts to solve these population-related social problems must consider the development of water resources. After all, water is needed whether it be for land development, culinary, industrial and agricultural, or recreational and aesthetic uses. Some of the things that can be done in relation to water resources to help solve some of our major social problems include (1) redesigning our evaluation methods for water resource projects, putting more emphasis on the contribution water resources can make in solving social problems; (2) analyzing and resolving the social blocks holding up planning and development at all governmental levels; (3) laying the groundwork for the necessary social institutions for development; (4) determining the best methods of establishing foreign agreements; (5) developing new ways of approaching the financing of reclamation projects; and (6) encouraging the acceptance of the concept of a national water system. (See also W72-04878) (Settle-Wisconsin)
W72-04889

PARTIAL SOLUTIONS--THE OUTLOOK,
Bureau of Reclamation, Washington, D.C.
F. E. Dominy.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 54-58.

Descriptors: *Water requirements, *Water supply, *Planning, Waste water treatment, Phreatophytes, Groundwater, Precipitation (Atmospheric), Desalination, Inter-basin transfers.
Identifiers: Central Arizona Project.

The growing water requirements of the West coupled with the dwindling sources of unused water have forced us to find ways to augment Western water supplies. The partial solutions which are available to us are encompassed by two broader categories, (1) those activities which artificially augment natural water sources, and (2) those measures which obtain the maximum beneficial use of a given water supply. The partial solutions in the first category include (1) precipitation management or 'cloud seeding,' (2) desalination of ocean water, and (3) interbasin transfers. Controlled experiments suggest that precipitation management may well be a viable alternative, while other studies indicate that large-scale desalination plants could possible produce relatively cheap water. Solutions in the second category include (1) waste water renovation, (2) natural pollution abatement, (3) watershed treatment, (4) water harvesting through soil treatment, (5) phreatophyte eradication and control, (6) groundwater recovery, (7) evaporation reduction, (8) improvements in canal lining, and (9) improvements in water scheduling. The need for these partial solutions is illustrated by the Central Arizona Project which does not supply enough water to meet the needs of the affected area. (See also W72-04878) (Settle-Wisconsin)
W72-04890

WATER RESOURCE INVESTMENTS AND NATIONAL GOALS,
Bureau of the Budget, Washington, D.C. Program Evaluation.
J. W. Carlson.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 59-62. 8 ref.

Descriptors: *Water resources development, *Social impact, *Economic impact, Cost-benefit analysis, Pricing, Population, Municipal water, Industrial water, Economic efficiency.

Changing economic and social conditions and priorities require alterations in the whole array of

public and private investment, including our approaches to water development. These necessary changes raise several questions, the answers to which are neither simple nor easy to find. Yet, the questions need to be asked if for no other reason than to assist the water specialist to develop an analytic framework for solving problems associated with water resources development. Less than half of the nation's recent major water resource construction starts appear to be aimed at solving problems arising from municipal and industrial growth. Are we neglecting the burgeoning needs in this area. Can we both meet the needs of the cities and also assist farmers in maintaining their incomes. How should we allocate public investment resources among the various regions of the country. How can we more adequately measure benefits and costs. Can we insure the economic and technical efficiency of water development projects. Should changes be made in water pricing and acreage limitations for water rights. (See also W72-04878) (Settle-Wisconsin)
W72-04891

ALTERNATIVE WATER POLICIES FOR AN ARID REGION,
California Univ., Davis. Economic Research Service; and California Univ., Davis. Dept. of Agricultural Engineering.
C. V. Moore, and J. H. Snyder.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 63-67. 4 ref.

Descriptors: *Water policy, *Arid climates, *Resource allocation, Economic efficiency, Technical feasibility, Water utilization, Measurement, Legal aspects.

On a number of criteria there is a strong indication of misallocation of water resources in the West. Empirical evidence alone suggests that the present system of Western water allocation fails a rigorous application of the criteria of economic efficiency. While it is economically infeasible to undertake major reallocations of water in order to improve efficiency, there are certainly some possibilities for improvements at the margin. One marginal improvement would be to allow leasing of water rights on an annual basis. This technique is already applied in some states. One positive benefit of leasing rights would be the elimination of economic irreversibility in allocating limited water supplies. A second possibility for improvement is to add rigor to the term 'reasonable use.' A tougher definition would presumably prevent the low water use efficiencies currently observed where water is cheap and abundant. Another improvement would be to require all diverted water to be measured by, say, flow meters when delivered to its final user, and to be sold on a unit basis. A final alternative would be for states to set a minimum price for diverted water, that is, assign a shadow price to it. (See also W72-04878) (Settle-Wisconsin)
W72-04892

ALTERNATIVES IN WATER MANAGEMENT,
California Univ., Berkeley. Dept. of Sanitary Engineering.
P. H. McGauhey.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 68-70.

Descriptors: *Water quality control, *Management, *Water requirements, Water conveyance, Inter-basin transfers, Desalination, Groundwater, Costs.

There are few clear-cut alternatives available for solving the West's water problems within the context of water quality management. Rather, there are a number of courses of action which in one combination or another are possible, and even inescapable. These alternatives include (1) large-scale transfers of surplus water; (2) desalination of ocean water at the downstream end of Western rivers, thereby releasing more fresh water for use upstream; (3) desalination of groundwater in the Southwest for local use, thus either decreasing demand on present supplies or providing for an expansion of the economy; (4) sequential use of water after partial restoration of quality; and (5) a downward revision of our ideals of water quality in order to more nearly equate reality with our desires. An evaluation of these alternatives suggests that the future outlook is not particularly bright. In the matter of water transfers, progress will undoubtedly be very slow. The cost of desalination of ocean water remains excessive as does the partial restoration required for sequential use. Desalination of saline ground water in the Southwest is the one alternative that may become a reality in the foreseeable future. (See also W72-04878) (Settle-Wisconsin)
W72-04893

THE ROLE OF RECREATION AND ENVIRONMENTAL QUALITY IN WATER MANAGEMENT,
Bureau of Outdoor Recreation, Washington, D.C.
W. C. Dent.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 71-74.

Descriptors: *Recreation, *Environmental effects, *Water management (Applied), Water quality, Water pollution, Multiple-purpose reservoirs, Legal aspects.
Identifiers: Environmental quality.

Recreation and environmental quality should be recognized as major purposes in water management and as having equal weight with other water management objectives. One major example of the extent to which water quality, recreation, and environmental quality have been recognized as alternatives in water management is the Wild and Scenic Rivers Act of 1968. Numerous problems, conflicts, and constraints arise in attempting to relate recreation and environmental quality to other aspects of water management. Water is frequently polluted; shorelines are often preempted for other purposes; and natural waters, existing impoundments, and good reservoirs sites are not always readily accessible to the large proportion of our people who live in or near the large cities. Another group of problems concerns the question of single-purpose versus multiple-purpose management of water resources. This includes such matters as choices between scenic rivers and dams. Problems also arise concerning the question of recreation as a legal, beneficial use of water: although federal laws now recognize recreation and environmental quality as primary management objectives, some states do not recognize the recreation objective. Other problems arise because of the imbalance between the supply of and demand for recreation water. (See also W72-04878) (Settle-Wisconsin)
W72-04894

A NATIONAL POLICY FOR WESTERN WATER DEVELOPMENT,
House, Washington, D.C.
W. N. Aspinall.
In: Water and Western Destiny: From Conflict to Cooperation, Proceedings of the Third Western Interstate Water Conference, 1969, Colorado State University, Fort Collins, Colorado, p 75-76.

Descriptors: *Water policy, *Water resources development, *Federal project policy, *Project planning, Water requirements, Planning, Governments.
Identifiers: *National water policy, *Colorado River Basin Project Act.

Titles I and II of the Colorado River Basin Project Act explicitly and implicitly set out a national policy for Western water development. More particularly, Section 102 (b) of the Act is both specific enough and broad enough to guide programs in this area for many years to come. Two key phrases appear in this act. The first is '...to the end that an adequate supply of water may be made available...' These words seem to clear up any doubt as to whether water requirements are intended to be met at times and places of their occurrences. The second phrase is '...consultation with affected States...' A strict interpretation of this passage seems to limit the non-Federal role to one of advice. If state and local leaders follow this interpretation, however, desirable plans may never be formulated, and, if formulated, may never be implemented. Fortunately, evidence suggests that the states intend to seek a larger role than merely one of consultation. Further movement toward a more active role for the states might include a greater assumption of responsibilities by non-Federal planning bodies and increased willingness to revise state water codes. (See also W72-04878) (Settle-Wisconsin)
W72-04895

THE IMPORTANCE OF ECOLOGICAL STUDIES AS A BASIS FOR LAND-USE PLANNING,
Michigan Univ., Ann Arbor.
S. A. Cain.
Biological Conservation, Vol 1, No 1, p 33-36, October 1968.

Descriptors: *Ecology, *Land use, *Planning, *Decision making, *Environment, *Management, *Quality control, *Resources, Economics, Political aspects, Social aspects, Long-term planning.
Identifiers: *Hard sciences, *Resources use, *Ecological information, *Ecological relationships, Research, Long-term consequences.

The results of the hard sciences must be unified by ecology, if natural resources are to be wisely managed and an environment of quality maintained or restored. The problems of resource use are not solved only by the natural sciences, since each resource problem has economic, political, and social parameters. Seven costly mistakes made from a lack of ecological information and a feeling for ecological relationships in nature are discussed. The attractions of immediate profit and the influence of traditional practices cause faulty planning which ignores possible long-term consequences of actions. Some progress has been made in the field of environmental quality. Knowledge of freshwater systems is being used in fish-pond developments. Aquaculture is being extended to salt and brackish waters. Reservoirs and lakes are being stocked with selected organisms to fill out a productive food-chain. Forest and range units are becoming more productive of a wide variety of goods and services. Systematic, long-term research into the central Pacific Ocean as a complete environmental system has led to the discovery of the equatorial undercurrent. The United States Soil Conservation Service has matured into a land capability system. Comparative agrobiology and agroclimatology are guiding land use developments. Identification and study of planktonic eggs have led to the discovery and development of Pacific Hake resources. Health programs are being founded on detailed ecological knowledge. (Strachan-Chicago)
W72-04936

ENVIRONMENTAL POLICY IN A HYPERTROPHIC SOCIETY,
Indiana Univ., Bloomington. Dept. of Political Science.
Lynton K. Caldwell.
Natural Resources Journal, Vol 11, No 3, July 1971, p 417-426, 11 ref.

Descriptors: *Environment, *Social aspects, *Priorities, *Political aspects, Social change, Political constraints, Environmental effects.

Identifiers: *Environmental policy, *Hypertrophic society, *Environmental quality, *Economic growth, Goals, Policy, National Environment Policy Act, Objectives.

The tendencies of contemporary American society to inordinate and uncontrolled growth are fundamentally incompatible with the objectives of the environmental quality movement as expressed in the National Environmental Policy Act. Certain short-term, partial, or incremental improvements in environmental conditions may be compatible with unrestricted growth; but the sheer magnitude of the problems created by ever-increasing numbers of people, goods, and services, and the mobile interactions among them, will frustrate all efforts to create or maintain quality environments. Fortunately, representative democracy contains the potentiality of self-correction. Socio-ecological collapse does not seem to be an inexorable end for the hypertrophic society - at least its probability cannot be proved, and the art of political leadership in our time should be directed to insure, as best we may, that it does not occur. All social and political systems change and the constructive task of politics is to speed the transformation of the present system into a more stable and self-renewing society. The task is to cure the patient of the 'disease' of societal hypertrophy, not to eliminate the symptoms by killing the patient. And, if in spite of our best efforts, we are unable to avoid disaster, some moral satisfaction may be gained by the knowledge that our failure was not a failure of nerve or will. If man is inherently unequal to the task, the outcome may be tragic, but it will be neither disgraceful nor absurd. To blunder into ecological disaster through the hypertrophic tendencies now in momentum, would be both. (Davis-Chicago)
W72-04938

PERIOLOUS LINKS BETWEEN ECONOMIC GROWTH, JUSTICE AND ECOLOGY: A CHALLENGE FOR ECONOMIC PLANNERS,
Boston Industrial Mission, Cambridge, Mass.
N. J. Faramelli.
Environmental Affairs, Vol 1, No 1, p 218-227, April 1971. 5 ref.

Descriptors: *Economics, *Ecology, *Planning, *Environment, *Pollution abatement, *Quality control, Costs, Cost allocation, National income, Value, Technology.
Identifiers: *Economic justice, *Distributive justice, *Economic planners, Material growth, Redistribution, *Steady state, *Economy, Standard of living, Long range global view.

Environmental quality can be achieved by either expansive applications of pollution control technology, or by a long range reduction in the production of material goods. In either case, there will be severe repercussions on the poor. This neglect of the poor, and the impact of specific ecology solutions on them, are among the weakest links in the ecology movement. The relationship of ecological responsibility to economic justice needs to be explored. In no sense is ecology an issue which belongs to everyone, for someone will have to pay for environmental quality. Such considerations as equal cost sharing for pollution control, economic growth and environmental destruction, and economic growth and employment levels, are discussed. A long-range global view, based on two premises, one from thermodynamics, and the other from soical ethics, is presented. (1) Sustained infinite material growth cannot be maintained in a finite biosphere. (2) The issue of economic or distributive justice is at stake. New challenges to the economic planner are presented. (1) A redistribution of the national income and a refocusing of national priorities will become imperative if economic justice is to prevail. (2) The American value schema needs to be transformed. (3) The conceptual framework of economics for developed nations must be shifted from one of endless growth to a 'steady state' economy for goods in the polluting sector. Even if technical fixes are available, economic justice cannot be a global reality as long as Americans, who desire to increase their standards of living, consume such a disproportionate amount of the worlds's material and energy resources. (Strachan-Chicago)
W72-04956

ECOLOGY AND TECHNOLOGY IN TWENTIETH-CENTURY LANDSCAPES,
Newcastle-upon-Tyne Univ. (England).
B. Hackett.
Biological Conservation, Vol 1, No 2, p 117-122, January 1969. 4 ref.

Descriptors: *Ecology, *Technology, *Landscaping, *Dominant organisms, *Land management, Multiple purpose projects.
Identifiers: *Landscape design, *Dominance, Participation, Policy making, Scientific basis, Form, Concepts, Principles, Evolution.

Technology cannot afford to ignore ecology, but there is a lack of understanding between the ecologist and the landscape architect as to the part which ecology can play in landscape design. Man has been a participant in the natural landscape and could certainly be considered as playing this role in seventeenth and eighteenth-century England. There is also a philosophical view of Man's participation in the landscape. The ecologist accepts the fact of dominance, and properly introduced, Man as a technologist could be accepted as the dominant in landscape. Natural principles are inherent in landscape, and they have the characteristics of form in the design sense; they also have a scientific basis, both form and science being relevant in technology. Five examples are given of the use of natural principles and ecological concepts in landscape design. Change and evolution are historical facts in landscape, but new changes should take account of the 'physiology and anatomy' of landscape. Arguments are put forward for the acknowledgement of ecological principles and facts in man-made changes, and the practices of multiuse and diversity are advocated. Finally, the problem of equating the rapid developments of technology with the time-lag of landscape change is discussed. (Strachan-Chicago)
W72-04980

ENVIRONMENTAL POLICY AND POLITICS: VALUE AND POWER CONTEXT,
New Mexico Univ., Albuquerque. Program for Advanced Study in Public Science Policy and Administration.
Daniel H. Henning.
Natural Resources Journal, Vol 11, No 3, p 447-454, July 1971. 21 ref.

Descriptors: *Environmental effects, *Environment, *Political aspects, *Political constraints, *Social values, *Decision making, Administration, Attitudes, Social aspects, Social impact.
Identifiers: *Environmental policy, *Policy, *Values, Political power, Economic values, Ideology.

Values encompass ends, goals, interests, beliefs, ethics, biases, attitudes, traditions, morals, and objectives which have a significant input into the power sphere. Policy is a statement of principles and objectives which serves as a guide or framework for operation of any agency or an area of responsibility. In the political and administrative process of environmental policy, it is appropriate to recognize that environmental values may be only limited or partial input in the power struggle for decisionmaking. Factors such as agency survival and expansion are a definite part of the process, where power itself can become a goal or value. In order to affect or influence a policy decision, a particular value must have power over other values and this political process occurs through human interaction. Politics is recognized as an arena where powerful economic, social and ideological interests and values compete to attain their objective through government. Environmental policy becomes a political concern when: segments of the public are affected in a negative or positive manner; a particular environmental segment or natural resource has possbilities for utilization with automatic alternatives and alignments created; and economic, social, and ideological impacts are present or possible. Modern public administration appears to operate on a crisis basis with an immediate problem-solving orientation. At present the political climate and changing conditions do not appear to give much stability and authority to policy in general. Regardless of the complexity or ambiguity of value identification and alliances, values must be recognized as the basis for power conflict and alliances for environmental policy. (Davis-Chicago)
W72-04985

THE ENVIRONMENTAL MOVEMENT: AMBIGUITIES AND MEANINGS,
California Univ., Santa Cruz.
Grant McConnell.
Natural Resources Journal, Vol. 11, No. 3, July 1971, p 427-436, 1 ref.

Descriptors: *Environment, *Environmental effects, *Social aspects, *Social change, *Social values, Priorities, Resource allocation, Decision making, Economics.
Identifiers: *Environmental movement, *Economic materialism, *Goals, Policy, Economic goals.

The mercurial rise of the present movement to rescue the environment is one of the most striking social phenomena of recent times. Several observations can be made about the environmental movement. First, a concern with the quality of the environment is not new. Second, there is a profound ambiguity in the movement dating from a similar ambiguity within the old conservation movement. On one hand, a very substantial faction is found proclaiming that the goals of economic growth and developments are overriding, provided only that benefits are not monopolized. This faction enjoys entrenched positions in both government and business. On the other hand, another and rapidly growing faction is demanding that first importance be recognized in an expanding range of policy decisions for the quality of the environment. By the same token, it seeks relegation of economic considerations to secondary status. Third, the environmental movement is unlikely to disappear. It has a long history and its emergence as a substantial force is sudden in appearance only. What is new that it has just recently achieved the critical mass necessary to command serious public attention. The environment movement has had a significant effect in helping to bring about a massive change of outlook, one that is rejecting the total primacy of economic materialism; but the future trend is evident. While the emphasis of American society upon material values is unlikely to disappear, it may well be progressively curtailed as a search for alternative values becomes increasingly prominent. This change of outlook is what the environmental movement will probably prove to be about. (Davis-Chicago)
W72-05021

COOPERATION OF GOVERNMENT, SCIENCE, AND INDUSTRY IN RESEARCH AND DEVELOPMENT - A SYSTEMS VIEW,
Planungsabteilung Bundeskanzleramt, Bonn, (West Germany).
Dieter Schumacher.
Policy Sciences, Vol. 2, 1971, p 279-286, 2 fig.

Descriptors: *Systems analysis, *Planning, *Environment, Government, Inter-agency cooperation, Long-term planning, Communication, Management, Social change, Decision making.
Identifiers: Integrative socioeconomic planning, Policy, Policymakers.

The roles of government, science and industry in meeting the research and development requirements of our society are investigated. The present 'state of the art' of the cooperation involved is considered and the need for integrated planning, programming, and budgeting in research, development, and technology is emphasized. The most difficult challenge, however, and a check of the integrating powers of government, science, and industry is the environmental issue. The interdependencies in this field are so wide that here research and development policymakers are completely lost without integrative socio-economic planning and action. Environmental research and development will be a prime case study for the cooperation of government, science and industry in the near future. The decisive issue will be the ability or nonability to overcome the gaps in communication and integration which are of course essential managerial skills too. Management of research and development today is management of change and this has more to do with management by communication and integration than is nowadays realized by government, science and industry. (Davis-Chicago)
W72-05075

FORECASTING PLANNING,
Center for Environmental Studies, London (England).
A. G. Wilson.
Urban Studies, Vol. 6, No. 3, p 347-367, November 1969. 31 ref.

Descriptors: *City planning, *Decision making, *Future planning (Projected), Analysis, Evaluation, *Forecasting, Methodology, Technology, Efficiencies, Institutions.
Identifiers: *Urban planning, *Patterns, Actions, Goal formulation, Developing planning capability, Public participation.

Urban planning has an influence on the future. Any speculation about developing patterns must include a study of possible developments of the planning system, and the impact of any changes on the developing patterns. This can be regarded as the problem of forecasting 'planning' itself. This article discusses the issues related to the future of planning which need to be given more attention. There are three main types of planning tasks which are concerned with policy, design, and analysis. These activities can be classified in three groups: actions, goal formulation and evaluation. First, the article considers planning capability in relation to new and improving methodologies. Second, the article discusses how the developing planning capability should be applied. Two kinds of developments in planning are discussed in this article: (1) increasing planning capability in a technical sense and concern for efficiency, and (2) increasing public participation and concern for the democratization of planning. The key to possible developments in planning lies in the developments of institutions which are associated with planning. (Strachan-Chicago)
W72-05082

ECOLOGY AND MAN, THE DILEMMA OF OUR TECHNOLOGICAL CULTURE,
North Carolina Univ., Chapel Hill. School of Public Health.
C. M. Weiss.
Presented at: 20th Southern Water Resources and Pollution Control Conference, Duke University, April, 1971, 12 p. 4 ref.

Descriptors: *Ecology, *Technology, *Environmental effects, *Economics, *Resource allocation, Preservation, Conservation.
Identifiers: *Resources mismanagement, *Resources renewal, Nature, Minimal degradation.

For generations Man has fitted into his environment. At present, his activities are disturbing the structure of the environment and serious questions are being raised as to what role Man should play in establishing dominance over his environment. This contemporary problem is not a new problem, but a problem which has become exaggerated by man's technological capabilities. Ecology can be described as the economy of nature. In the continuing mismanagement of the environment, Man has become increasingly aware of how both the organic and inorganic elements of the planet are interrelated. The question of the use of renewable and non-renewable resources is of particular concern to the management of the environment. Although Man is still part of nature and cannot escape the question of how much of nature he can destroy without destroying himself, it would appear that Man needs to develop a new conscience, a conscience which would consider the total ecological system. Man and his capability for adaptation must establish a stability and a variety in his use of this environment. There must be preservation of major biological communities to preserve the necessary gene pool of plants and animals. The cities must be made into viable units that minimize the degradation of mind and body. (Strachan-Chicago)
W72-05084

A COMPUTERIZED EDUCATIONAL PROGRAM FOR THE APPLICATION OF THE MANAGEMENT SCIENCES TO WATER RESOURCE MANAGEMENT,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 07C.
W72-05088

URBAN SOCIAL THEORY AND RESEARCH,
Kent Univ., Canterbury (England). Faculty of Social Sciences.
R. E. Pahl.
Environment and Planning, Vol. 1, No. 1, 1969, p 143-153, 32 ref.

Descriptors: *Urban sociology, *Resource allocation, *Social aspects, *Management, Cities, Economics, Decision making.
Identifiers: *Urban social theory, *Social science research, *Urban problems, *Social constraints, *Spatial constraints, Sociology, Social structure, Urban resources, Urban facilities.

A critical examination is made of the state of urban social theory and research. A redefinition of sociology might provide a distinctive approach to urban problems and may have possibilities of enlarging our basic understanding of the social structure of an advanced industrial society. The main propositions are: 1) there are fundamental spatial constraints on access to scarce urban resources and facilities, 2) there are fundamental social constraints on access to scarce urban facilities, 3) populations in different localities differ in their access and opportunities to gain the scarce resources and facilities holding their economic position or their position in the occupational structure constant, and 4) conflict in the urban system is inevitable. The basic framework for urban sociology is then the pattern of constraints which operates differentially in given decision-making contexts. A truly urban sociology should be concerned with the social and spatial constraints on access to scarce urban resources and facilities as dependent variables, and the managers or controllers of the urban system seen as the independent variable. Whether this provides 'theoretical yield' at a general level is not dependent on subject material but on quality of schlorship. (Strachan-Chicago)
W72-05121

WHERE WILL ALL THE PEOPLE GO. HOW MUCH WILL THEY DUMP WHEN THEY GET THERE -- POPULATION DISTRIBUTION, ENVIRONMENTAL DAMAGE, AND THE QUALITY OF LIFE,
RAND Corp., Santa Monica, Calif.
A. H. Pascal.
The Annals of Regional Science, Vol. 5, No. 1, p 1-5, June 1971.

Descriptors: *Population, *Environment, *Quality control, *Effluents, Spatial distribution, Estimation, Standards, Planning, Decision making, Costs.
Identifiers: *Quality of life, *Population distribution, *Externalities, *Affluence, *Long term research program, Spatial settlement pattern, Policymaking, Cost magnitude, Cost incidence.

The belief that the United States contains, or will contain, too many people has been one of the shortest lived 'crisis' in the long history of the 'problem-mongering' industry. The absolute number of people is not a very persuasive threat to the integrity of the environment or the quality of life. In downplaying the role of population growth in the degradation of the environment, no claim is made that there has been no degradation in environmental quality and urban life. It is the way that people live which creates externalities, and not just sheer numbers. Affluence continues and effluents keep pace with it. The threat of affluence and effluents to environmental quality is largely a function of how the American population patterns itself over the national space. A long term research program on the question of population distribution is proposed. Five tasks of such a research program are identified: (1) forecasting the spatial settlement pattern for the United States in the year 2000, (2) estimating the threat to the environment, (3) specifying environmental quality standards, (4) identifying and assessing policy mechanisms, and (5) calculating the magnitude and incidence of costs.
W72-05123

PLANNING FOR PEOPLE, NOT BUILDINGS,
Harvard-MIT Joint Center for Urban Studies, Cambridge, Mass.
H. J. Gans.
Environment and Planning, Vol. 1, No. 1, 1969, p 33-46, 8 ref.

Descriptors: *Planning, *City planning, *Social aspects, *Political aspects, *Priorities, Environment, Social values, Attitudes, Social needs, Social participation, Community development, Resource allocation.
Identifiers: *Physical environment, *Public goals, *Alternatives, *Public benefits, Goals, Public values, Choice, Electorate, Elected officials, Programs.

It is argued that city planning has concerned itself primarily with buildings and the physical environment, and only secondarily with the people who use that environment. It is suggested that the aim of planning is to help people solve their problems and realise their goals. The planner is viewed not as a reformer, nor a professional who is free to impose his expertise and his values on the people for whom he plans but as a public official who is their servant, helping them solve their problems and achieve their goals, except when these goals have antisocial and self-destructive consequences. In this process, the planner ought to propose a variety of programs to solve problems and achieve goals so that people have maximum choice; and within this context, he ought to be free to include some programs that are based on his own goals. When it comes to planning for heterogeneous populations, where the public interest is difficult to determine, he has to take a political stand, and propose the allocation of resources so that the maximal benefits accrue to those people, interest groups, and communities he feels are in the greatest need of public benefits. The prime function of the planner, however, is not to determine goals, for that is the duty of the elected official and of the electorate. The planner ought to concern himself principally with determining the best programs for achieving goals, devote himself to programs which will realize these goals. In this process he must also plan for the physical environment, but he must devote himself first to people, and only secondarily to buildings. (Davis-Chicago)
W72-05133

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

WATER RESOURCES PLANNING,
National Wildlife Federation, Washington, D.C.
For primary bibliographic entry see Field 06B.
W72-04885

6D. Water Demand

POPULATION GROWTH IN COMMUNITIES IN RELATION TO WATER RESOURCES POLICY.
Rivkin/Carson, Inc., Washington, D.C.
For primary bibliographic entry see Field 06B.
W72-04785

MUNICIPAL, INDUSTRIAL, AND IRRIGATION WATER USE IN WASHINGTON, 1970,
Geological Survey, Tacoma, Wash.
G. G. Parker, Jr.
Geological Survey Open-file Report, 1971. 21 p, 8 fig, 5 tab, 1 ref.

Descriptors: *Water supply, *Water users, *Water yield, *Washington, Hydrologic data, Municipal water, Industrial water, Irrigation water, Water demand, Forecasting, Surface waters, Groundwater.

Data are presented which give an assessment of municipal, industrial, and irrigation water use in Washington (state) in 1970, and projections of water use in 1985. Total municipal water use in 1970 was 331 billion gallons. Industry used 388 billion gallons, of which 170 billion gallons was from the municipal systems and 218 billion was self-supplied. Of the 549 billion gallons of water used for municipal and industrial supplies, 162 billion gallons was groundwater, 373 billion gallons was fresh surface water and 14 billion gallons was saline surface water. About 70% of the industrial water use was by the paper and allied products industry. In 1970, 6.29 million acre-feet of water was applied to 1.40 million acres. This was 94% surface water and 6% groundwater. Total industrial water use is projected to exceed 500 billion gallons in less than 10 years and could exceed 700 billion gallons by 1985. Municipal water use may exceed 420 billion gallons within 10 years and 480 billion gallons by 1985. Irrigation water may be 7.2 million acre-feet applied to 1.6 million acres by 1975. (Woodard-USGS)
W72-04816

WATER AND WESTERN DESTINY: FROM CONFLICT TO COOPERATION.
Colorado State Univ., Fort Collins. Environmental Resources Center.
For primary bibliographic entry see Field 06B.
W72-04878

THE ROLE OF RECREATION AND ENVIRONMENTAL QUALITY IN WATER MANAGEMENT,
Bureau of Outdoor Recreation, Washington, D.C.
For primary bibliographic entry see Field 06B.
W72-04894

WESTERN RESOURCES CONFERENCE 1970. URBAN DEMANDS ON NATURAL RESOURCES.

University of Denver Press: Denver, Colo., 1970. 295 p.
Identifiers: Book, Conference, Natural, Resources, Urban, Western.

The Western Resources Conferences are part of an ongoing cooperative program of education and research in the conservation and development of natural resources in the western USA. It consists of a series of annual conferences, rotating among the campuses and focused upon resource areas of special urgency. This 1st published conference was held at the University of Denver and reflects its urban location by directing the program toward an examination of the pressures that urban growth places upon the natural resources of its region since many of the most urgent environmental problems of contemporary America are rooted in the urban community. This 1970 conference is divided into 5 sessions on various topics in conservation and natural resource development: air motion and weather as viewed in urban conditions; water systems and wastewater; energy and raw materials; control of land resources in urbanizing regions; and goals and methods of urban resource decision making. Two sessions include panel discussions. All conferences in this series will be published by host institutions.--Copyright 1971, Biological Abstracts, Inc.
W72-04951

THE REUSE OF WATER IN MANUFACTURING: AN EXPLANATORY ECONOMIC MODEL WITH DATA ANALYSIS,
New Mexico State Univ., University Park. Water Resources Research Inst.
For primary bibliographic entry see Field 03E.
W72-05093

6E. Water Law and Institutions

ADMINISTRATIVE ALLOCATION OF WATER,
National Water Commission, Arlington, Va.
Clyde W. Edward, and Jensen W. Dallin.
Available from the National Technical Information Service as PB-205 249, $3.00 paper copy, $0.95 in microfiche. National Water Commission Final Report No L-71-025, July 1, 1971, 126 p. 8 ref.

Descriptors: *Administrative decisions, *Water law, *Permits, Preferences, Unappropriated water, Water permits, *Water rights, Well permits, Well regulations.
Identifiers: *Administrative law, *Conjunctive management, *Integrated management.

This paper, Legal Study 3, defines the concept of administrative allocation of water and contrasts it with market allocation, noting that in the Western United States, initial allocation of water and water rights is usually administrative and subsequent reallocation is usually made through market exchange, current criteria for market allocation are examined and improvements are suggested. Allocation by the Bureau of Reclamation and the Corps of Engineers is discussed briefly as is conjunctive management programs. (NWC)
W72-04786

SOME SOCIAL ISSUES AND ALTERNATIVES INVOLVED IN PLANNING WATER RESOURCES WITH PEOPLE IN THE WEST,
Utah State Univ., Logan. Dept. of Sociology.
For primary bibliographic entry see Field 06B.
W72-04889

A NATIONAL POLICY FOR WESTERN WATER DEVELOPMENT,
House, Washington, D.C.
For primary bibliographic entry see Field 06B.
W72-04895

A NEW DIMENSION OF STATE PLANNING -- POLICY DEVELOPMENT AND ISSUE ANALYSIS,
Washington State Planning and Community Affairs Agency, Olympia.
R. H. Slavin.
The Annals of Regional Science, Vol. 4, No. 1, p 61-68, 1970. 2 fig, 4 ref.

Descriptors: *Planning, *Decision making, *State governments, *Institutional constraints, *Governors, Data collecting, Political aspects, Formulation, Administration, Coordination, Evaluation, Future planning (Projected), Environment, Resources.
Identifiers: *Policy making, *Policy development, *Issue analysis, *State planning systems, Information processing systems, Policy analysis, Goals and objectives.

State planning systems are essentially gubernatorial information processing systems in which information takes the form of data about objectives, environment, resources, and components. The political reality of this situation does not lend itself readily to the formulation of a mathematical model. The article discusses the role of the governor in the planning process. A governor needs a flexible staff structure and a highly competent and adequate sized staff. Lawyers and journalists are the two main-stays of governors' offices. The governor's office is traditionally weak in policy analysis. Too frequently, the governor does not innovate, but only reacts, responds, and modifies departmental policy and programs. A gubernatorial policy planning section concerned with the formulation of administration goals and analysis, policy formulation, program development, coordination and evaluation of planning activities is needed. Another immediate need of gubernatorial staff systems is an improved method of issue analysis. Issue analysis can be used to implement policy, to coordinate planning, and to complement state functional planning. It provides for the isolation of those problems which require unusual approaches to solutions, and for opportunities to test new programs. Most importantly, issue analysis projects the effects of today's decisions into the future. (Strachan-Chicago)
W72-05052

POLITICAL AND SOCIAL ACCOMMODATION: THE POLITICAL PROCESS AND ENVIRONMENTAL PRESERVATION,
Colorado State Univ., Fort Collins.
N. Wengert.
Natural Resources Journal, Vol. 11, No. 3, July 1971, p 437-446, 5 ref.

Descriptors: *Political aspects, *Social aspects, *Political constraints, *Environment, *Planning, *Institutions, Social values, Attitudes, Priorities, Programs, Short-term planning, Long-term planning, Resources formulation.
Identifiers: *Accommodation, *Political process, *Professionalism, *Goals, *Policy, Political accommodation, Social accommodation, Environmental preservation, Public goals, Implementation, Perceptions.

Accommodation, in the minds of many, has a negati' connotation suggesting compromise. To accommodate the interests, views, and positions of others seems to be departing from concepts of professional integrity and violating professional ethics. Yet, the political process as we know it in America rests strongly on the recognition of the plural values, the differiing perceptions, and the multitude of goals of the population generally, and also on the recognition that most programs and policies are never fully 'right' or completely 'true'. A major problem is the question of what ends are being sought, whose ends, and how have these ends been determined. A part of the problem is that too often societal ends are short-range and limited in scope especially when dealing with resources and the environment. Planning represents a kind of rationality in relating ends to means, but in this frame of reference the stress is on instrumental rationality and not on absolute sets of principles or conclusions. The problems of goals in American politics is indeed a difficult one. We lack institutions charged with responsibilities for formulating and crystallizing public goals and behaving responsively and responsibly with respect to their implementation. Two consequences result from this situation: first, building

majority support (or simply acceptance) for a particular course of action is very difficult and second, a major consequence of our weak policy and goal setting institutions is the fact that planners and other bureaucrats are thrust into positions of playing substantial roles in program development and policy formulation, and in making choices as to what is good for society. (Davis-Chicago)
W72-05083

RIPARIAN WATER LAW. A FUNCTIONAL ANALYSIS,
Connecticut Univ., West Hartford. School of Law.
Clifford Davis.
Available from the National Technical Information Service as PB-205 004, $3.00 in paper copy, $0.95 in microfiche. National Water Commission Report No L-71-020 (Legal Study 2), October 1971. 81 p. NWC 70-012.

Descriptors: *Judicial decisions, *Natural flow doctrine, *Prescriptive rights, Recreation, *Riparian law, Riparian rights, Riparian waters, Water law, *Water permits, Water rights, Water transfer.

The allocation of water by the riparian water law system that obtains in the Eastern United States is described from the standpoint of both the text book law and results in fact. The study is supplemented by several case studies and includes an examination of Eastern permit systems. Recommendations are included for improvement of the system. (Meyers-NWC)
W72-05097

LEGAL ASPECTS OF WATER SALVAGE,
National Water Commission, Arlington, Va.
Richard L. Dewsnup.
Available from the National Technical Information Service as PB-205 005, $3.00 in paper copy, $0.95 in microfiche. Commission Report No L-71-021 (Legal Study 8-C), September 1971. 85 p, 10 ref.

Descriptors: *Administrative decisions, Judicial decisions, Prior appropriation, *Water law, *Water permits, *Water rights, Well regulations, Economic efficiency.
Identifiers: *Water waste.

The various ways in which water is lost to use through such processes as seepage, evaporation and transpiration were identified, and the extent to which state water law doctrines encourage or discourage salvage of such losses. It is concluded that in many respects legal reforms are needed in order to encourage salvage operations, and are proposed. This report is based on a National Water Commission staff study of new water values. Other parts of that study are covered in two other NWC publications: (1) Legal Protection of Instream Water Values and (2) Public Access Rights in Waters and Shorelands. (See also W72-05099 and W72-05100) (NWC)
W72-05098

LEGAL PROTECTION OF INSTREAM WATER VALUES,
National Water Commission, Arlington, Va.
Richard L. Dewsnup.
Available from the National Technical Information Service as PB-205 003, $3.00 in paper copy, $0.95 in microfiche. Commission Report No L-71-023 (Legal Study 8-A), September 17, 1971. 58 p, 6 ref.

Descriptors: Prior appropriation, *Public benefits, *Public rights, Recreation, Unappropriated water, *Water law, *Water rights.
Identifiers: Instream water values.

State water law doctrines were examined to determine to what extent they provide for legal recognition of recreational, fish and wildlife, esthetic, environmental, and other instream uses of water. Historically, Western water law required water to be diverted from the watercourse before a water right could be acquired -- accordingly, there was virtually no protection for instream uses. Recently, however, many states have enacted statutes to provide ways of protecting instream water values, and a number of these innovations were evaluated as a basis for suggesting further legislative reforms to protect instream values. This report is a part of a broader National Water Commission staff study on state legal reforms needed to protect new water values. Two other parts are (1) Public Access Rights in Waters and Shorelands and (2) Legal Aspects of Water Salvage. (See also W72-05098 and W72-05100) (NWC)
W72-05099

PUBLIC ACCESS RIGHTS IN WATERS AND SHORELANDS,
National Water Commission, Arlington, Va.
Richard L. Dewsnup.
Available from the National Technical Information Service as PB-205 247, $3.00 in paper copy, $0.95 in microfiche. Commission Report No L-71-022 (Legal Study 8-B), July 1, 1971. 71 p, 14 ref, append.

Descriptors: Ownership of beds, Proprietary power, *Public rights, *Recreation, *Riparian land, *Water law, *Water rights.
Identifiers: *Submerged lands act.

The historical development of legal doctrines which recognize rights of public access and use of waters for navigation and fishing was surveyed, and how such rights presently include general recreational use of waters and shorelands. The legal concept of navigability of waters is an important criterion for public use, but many states have found additional legal machinery for enhancing such public rights. A number of alternative ways in which the states protect or enhance public rights in waters and shoreland are discussed, and several of those alternatives are selected as recommendations for further state action. From the same National Water Commission staff study on new water values, two other reports were prepared: Legal Protection of Instream Water Values and Legal Aspects of Water Salvage. (See also W72-05098 and W72-05099) (NWC)
W72-05100

GROUNDWATER LAW, MANAGEMENT AND ADMINISTRATION,
Washington Univ., Seattle. School of Law.
Charles E. Corker, and James W. Crosby, III.
Available from the National Technical Information Service as PB-205 527, $6.00 in paper copy, $0.95 in microfiche. National Water Commission Report No L-71-026 (Legal Study No. 6), October 1971. 552 p, 3 ref, 3 append.

Descriptors: *Aquifers, *Groundwater, *Hydrogeology, Resource allocation, Overlying proprietor, Water law, Will permits.
Identifiers: *Groundwater mining, *Recharge.

Groundwater hydrology is described emphasizing the importance of recognizing the interrelation of ground and surface water supplies. The legal doctrines applicable to the use of groundwater are discussed, noting the differences among the states and the departure of law from scientific fact. Major problems of groundwater law are identified and solutions suggested. In considering groundwater management, criteria for judging management proposals are proposed, concluding with a consideration of constitutional limitations. The problem of groundwater mining is included. (NWC)
W72-05101

ENVIRONMENTAL POLICY AND THE CONGRESS,
U.S. Senate, Washington, D.C.
Henry M. Jackson.
Natural Resources Journal, Vol. 11, No. 3, July 1971, p 403-416, 27 ref.

Descriptors: *Federal government, *Environment, *Legal aspects, *Social aspects, Economics, Indicators, Aesthetics, Administration, Decision making, Resources allocation, Attitudes, Social values.
Identifiers: *Environmental policy, *Congress, *Policy, *Environmental quality, *Public involvement, Public perception, Public resources, Public values.

Over the past few years a very major change has taken place in the American public's perception of man's proper relationship to his environment. Traditional economic indices are no longer viewed as the sole measures of progress. We are entering an era in which qualitative values and aesthetic factors are considered as important as material well-being. People are no longer complacent about the quality of their surroundings, the use of the environment, or the way in which public resources are administered. Public concern has moved many of these issues squarely into the arena of public debate and decisionmaking. This change in the public's perception of environmental values has enormous, but still largely unexplored implications for public administration, for our judicial system, and for the continued viability of traditional legal concepts which define individual and public responsibilities in the administration of the environment. Our national ability to develop a comprehensive, balanced and effective environmental policy in the years ahead will be a vital factor in the future achievement of other important national goals. In this context, environmental policy is concerned with the total environmental needs of man: ethical, aesthetic, physical, and intellectual, as well as economic; implying a careful examination of all alternative means of meeting legitimate human needs. The concept of 'environment' like that of 'economics' cuts across the full fabric of our national life and today is becoming a major influence on a broad range of resource allocation decisions. (Davis-Chicago)
W72-05118

ENVIRONMENTAL POLICY: PUBLIC PARTICIPATION AND THE OPEN INFORMATION SYSTEM,
Environmental Reporter Foundation, Albuquerque, N. Mex.
Harvey Frauenglass.
Natural Resources Journal, Vol. 11, No. 3, July 1971, p 489-496, 11 ref.

Descriptors: *Environment, *Communication, *Management, *Institutional constraints, *Decision making, Institutions, Administration, Social aspects, Aesthetics, Operations, Cost-benefit analysis, Planning, Priorities.
Identifiers: *Environmental policy, *Policy, *Public participation, *Information systems, Resource management, Resource management philosophy, Information policy, Adversary process, Agency ombudsman, Citizen advisory board, Goals.

The level of awareness of the natural environment in the United States is today higher than it has ever been. For the first time questions are raised about basic operating assumptions, long-established procedures, standard methods of cost-benefit analysis, resource management philosophy, and aesthetic values. Along with the questions come requests for information, detailed information on every aspect of administration. The professional manager has typically not seen the need to accommodate these demands, and when it does see the need he does not know how. However, continued pressure has made it desirable for managers to modify their traditional information policy. All management information systems are guided by the same policy of self-protectiveness, secrecy, and elitism which characterizes closed systems; only seeking wide information from below if expedient. The management system of gathering and studying data has nothing to do with management

executive power or of the decision making authority. Sometimes this basic information system is modified superficially through the use of citizen advisory boards, agency ombudsmen, or formal adversary processes, in an attempt to satisfy the public. However, what the environmentalists want is a completely different kind of information policy, including not only an unrestricted information flow in both directions, but also a commitment to share responsibility for setting goals and making plans. This may be the only way to proceed with conservation and natural resource management programs. It is only through citizen participation that a society can truly further the social evolution of its citizens in reasonable harmony with the natural environment. (Davis-Chicago)
W72-05132

6F. Nonstructural Alternatives

AGRICULTURAL FLOOD DAMAGE ASSESSMENT: A REVIEW AND INVESTIGATION OF A SIMULATION METHOD,
Toronto Univ. (Ontario). Dept. of Geography.
G. T. McDonald.
Review of Marketing and Agricultural Economics, Vol 38, No 3, p 105-120, 1970. 5 fig, 6 tab, 22 ref.

Descriptors: *Flood damage, *Model studies, *Probability, Project planning, Flood plains, Historic flood, Frequency analysis, Estimating.
Identifiers: Wales.

The estimation of agricultural flood damage is essential in planning flood control projects. Currently used methods of damage assessment include the frequency method and historical flood series. These one-shot attempts, which are applied to a given set of works, are cumbersome and provide unreliable planning information. Advanced techniques for assisting design of works at an incremental level involve simulation and systems models which are flexible for use in resource allocation problems and amenable to computer application. The refinement of a model currently used for evaluating surface water development was envisaged in assessing flood damage on the Macleay River floodplain in Northern New South Wales. A sample case applied to part of the floodplain illustrates how the model estimates the efficiency of various damage-reducing alternatives. The inherent variability of the damage process itself suggests the use of probability measures. To demonstrate the use of the assessment model, range estimates sampled under rectangular probability assumptions are used to simulate variability. Unreliable basic data can be explicitly recognized by variance estimates. Flood damage estimation by this technique will allow more confidence to be placed in benefit-cost figures. (Haugh-Wisconsin)
W72-04877

ALTERNATIVE WATER POLICIES FOR AN ARID REGION,
California Univ., Davis. Economic Research Service; and California Univ., Davis. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 06B.
W72-04892

6G. Ecologic Impact of Water Development

GUIDELINES: BIOLOGICAL SURVEYS AT PROPOSED HEAT DISCHARGE SITES,
Pacific Northwest Water Lab., Corvallis, Oreg.
For primary bibliographic entry see Field 05G.
W72-04828

ECOLOGICAL AND PHYSIOLOGICAL IMPLICATIONS OF GREENBELT IRRIGATION,
California Univ., Riverside. Dept. of Plant Sciences.
V. B. Youngner, W. D. Kesner, A. R. Berg, and L. R. Green.
Second Annual Report of the Maloney Canyon Project, California Water Resources Center, Los Angeles, Contribution No. 135, 1971. 22 p, 6 fig, 3 tab. B-119-CAL (1), B-134-CAL (1) and B-090-CAL (2).

Descriptors: Irrigation, Conservation, Waste water disposal, Water reuse, Soil surveys, Wildlife, Ecology, Physiological ecology, California.
Identifiers: Maloney Canyon, San Bernardino National Forest (Calif), California Division of Forestry, Lake Arrowhead Sanitation District.

This progress report on Phase II of the Maloney Canyon Project, Ecological and Physiological Implications of Greenbelt Irrigation covers the period 7-1-70 thru 6-30-71. Thirty-six experimental plots were constructed and are under study. Twelve have had all native vegetation removed, and will be planted with various species of grasses, shrubs, and trees. Twelve have had vegetation cut back to 4-6 inches above ground level, and are used to study plant regrowth. Twelve are controls in which vegetation has not been disturbed. Studies underway are on vegetation, soils, and hydrological surveys. Preliminary small animal and deer surveys were made.
W72-04898

THE IMPORTANCE OF ECOLOGICAL STUDIES AS A BASIS FOR LAND-USE PLANNING,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 06B.
W72-04936

ENVIRONMENTAL POLICY IN A HYPERTROPHIC SOCIETY,
Indiana Univ., Bloomington. Dept. of Political Science.
For primary bibliographic entry see Field 06B.
W72-04938

PERIOLOUS LINKS BETWEEN ECONOMIC GROWTH, JUSTICE AND ECOLOGY: A CHALLENGE FOR ECONOMIC PLANNERS,
Boston Industrial Mission, Cambridge, Mass.
For primary bibliographic entry see Field 06B.
W72-04956

ECOLOGY AND TECHNOLOGY IN TWENTIETH-CENTURY LANDSCAPES,
Newcastle-upon-Tyne Univ. (England).
For primary bibliographic entry see Field 06B.
W72-04980

THE ENVIRONMENTAL MOVEMENT: AMBIGUITIES AND MEANINGS,
California Univ., Santa Cruz.
For primary bibliographic entry see Field 06B.
W72-05021

ECOLOGY AND MAN, THE DILEMMA OF OUR TECHNOLOGICAL CULTURE,
North Carolina Univ., Chapel Hill. School of Public Health.
For primary bibliographic entry see Field 06B.
W72-05084

NUCLEAR ENERGY FOR A NEW TOWN,
Rhode Island Univ., Kingston. Water Resources Center.
D. Hammerschlag, and V. C. Rose.
Available from the National Technical Information Service as PB-207 300, $3.00 in paper copy, $0.95 in microfiche. Final report, August 1971. 60 p, 29 fig, 8 tab, 57 ref. OWRR B-022-RI (1).

Descriptors: *Nuclear power plants, *Thermal pollution, Rhode Island, Sewage treatment.
Identifiers: Providence (R.I.), *New communities, *Waste heat.

Methods of utilizing waste heat from a proposed nuclear generating facility in industrial-municipal complexes were investigated. Several products and processes were proposed including marine pharmaceuticals, chemical production, municipal waste processes, food production and processing, and residential-recreational uses. Sewage treatment was selected as the most promising use of the heat. This non-seasonal process provided a solution to two regional problems, augmentation of municipal water supplies and elimination of a major source of pollution, (sewage). In the proposed system, sewage from the metropolitan Providence, R. I. area would be piped to the vicinity of the power plant, receive primary, secondary and tertiary treatment to convert it to potable water and be piped back to the city's reservoir system. Heat from the power plant would be used in each stage to accelerate the process. Cost of the entire system was estimated at 74.3 million dollars. A recreational community was also proposed as a means of utilizing a portion of the waste heat. In order to make optimum use of the Bay it was proposed that the entire complex be built on three multi-level man-made islands which would also support the piers of a bridge spanning the Bay. The lowest level would contain a large marina, parking facilities, and recreational areas for residents and visitors. Ten to fifteen successively smaller rings of housing would be provided on the upper levels. Hot water from the reactor would be used to heat and cool the complex, while waste heat disposed into the Bay would extend the season for marine recreation. Although the cost of the complex was not estimated the cost of the artificial islands could be partially assigned to the new bridge.
W72-05091

ENVIRONMENTAL POLICY AND THE CONGRESS,
U.S. Senate, Washington, D.C.
For primary bibliographic entry see Field 06E.
W72-05118

INFORMATION REQUIREMENT FOR SOCIO--ECOLOGICAL MODELS,
Hawaii State Dept. of Planning and Economic Development, Honolulu.
For primary bibliographic entry see Field 06A.
W72-05119

ENVIRONMENTAL POLICY: PUBLIC PARTICIPATION AND THE OPEN INFORMATION SYSTEM,
Environmental Reporter Foundation, Albuquerque, N. Mex.
For primary bibliographic entry see Field 06E.
W72-05132

PLANNING FOR PEOPLE, NOT BUILDINGS,
Harvard-MIT Joint Center for Urban Studies, Cambridge, Mass.
For primary bibliographic entry see Field 06B.
W72-05133

07. RESOURCES DATA

7A. Network Design

EXPANDED PROGRAM FOR PESTICIDE MONITORING OF FISH,
Bureau of Sport Fisheries and Wildlife, Washington, D.C.
For primary bibliographic entry see Field 05A.
W72-04740

CARTRIDGE MAGNETIC TAPE INCREMENTAL RECORDER FOR HYDRO-METEOROLOGICAL DATA ACQUISITION,
Padua Univ. (Italy). Istituto di Elettrotecnica e di Elettronica; and Centro Veneto di Richerche Idrauliche, Padua (Italy).
G. Rossi, and F. Russo.

International Association of Scientific Hydrology Bulletin, Vol 16, No 1, p 51-58, March 1971. 6 fig.

Descriptors: *Data collections, *Automation, Data storage and retrieval, Data processing, Instrumentation, Hydrologic data, Networks.
Identifiers: Magnetic tape recorders.

To aid the elaboration of hydrometeorological data by means of computers and at the same time to reduce to a minimum the work of the operator in obtaining data, eliminating the perusal of diagrams and data extraction from them, a cartridge magnetic tape recorder was built. It has a long recording run, low current consumption to permit battery operation, and cost is kept to a minimum. An appropriate reader-translator enables all the necessary information to be obtained from the data recorded on the magnetic tape cartridge and to generate from this a magnetic tape with an IBM-compatible format. (Knapp-USGS)
W72-04848

EVALUATION OF RADAR AND RAINGAGE SYSTEMS FOR FLOOD FORECASTING,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 02B.
W72-04966

EFFECTS OF RANDOM DATA ERRORS ON THE PARAMETER VALUES FOR A CONCEPTUAL MODEL,
Ministry of Works, Wellington (New Zealand). Water and Soil Div.
R. P. Ibbitt.
Water Resources Research, Vol 8, No 1, p 70-78, February 1972. 9 tab, 7 ref.

Descriptors: *Rainfall-runoff relationships, *Simulation analysis, *Synthetic hydrology, *Mathematical models, Parametric hydrology, Model studies, Infiltration, Evaporation, Water storage.

A conceptual model was used to generate synthetic error-free runoff data from precipitation and potential evaporation records. Random errors were then introduced into all three data records. By automatically and objectively fitting the model to different combinations of error-free and error-contaminated records, the effects of the errors on the fitting were studied. The value of the fitting criterion depends largely on the errors in the runoff record. The variations in the final parameter values for fittings to error-contaminated data were no greater than for the error-free case. The data may be used to find the sensitivity figures for each parameter by a method that is less localized than the standard perturbation technique. (Knapp-USGS)
W72-05029

7B. Data Acquisition

A QUANTITATIVE SAMPLER FOR AQUATIC PHYTOMACROFAUNA,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 05A.
W72-04710

A QUANTITATIVE PLANKTON SAMPLER,
Stockholm Univ. (Sweden). Asko Lab.; and Stockholm Univ. (Sweden). Dept. of Zoology.
H. Ackefors.
Oikos, Vol 22, No 1, p 114-118, 1971. 6 fig, 8 ref.

Descriptors: *Ecology, *Ecological distribution, *Sampling, *Water analysis, *Plankton, *Thermocline, Depth, Chemical analysis, Phytoplankton, Zooplankton, Plankton nets, Mechanical equipment, Distribution patterns.
Identifiers: Baltic Sea.

A new plankton sampler consists of a PVC-tube, with a capacity of 23 liters, fitted with top and bottom clack closing devices. A collecting bucket of plexiglas, and a nylon net filter are attached to the bottom clack. The sampler, which is light enough to be used by one man with a hand winch, is lowered to the desired depth (up to 200 meters), and the clacks closed by a messenger device. When the sampler is lifted out of the water, the water in the tube drains through the net. The net contents are then washed into the attached bucket which is fitted with a bottom filter and is easily removable. Field tests of the sampler at depths to 100 meters demonstrated the reliability of the sampler as well as its use for determining vertical distributions of organisms. The sampler can easily be modified to take water samples for chemical or phytoplankton studies. (Jefferis-Battelle)
W72-04713

A SIMPLIFIED TUBE BOTTOM SAMPLER,
Uppsala Univ. (Sweden). Inst. of Zoology.
G. Milbrink.
Oikos, Vol 22, No 2, p 260-263, 1971. 2 fig, 1 tab, 11 ref.

Descriptors: *Core drilling, *Bottom sediments, *Sampling, Benthic fauna, Spatial distribution, Benthos, Mechanical equipment.
Identifiers: Jenkin tube, Ekman sampler.

A basic coring device for bottom mud sampling and two other versions of it are described. The basic device consists of a valve on top of a standard Jenkin sampler tube, which is gently pushed into the mud. The tube has a sharpened lower edge that makes it effective in hard clay and because of its small dimensions is suitable for sampling through narrow holes in ice or from small vessels. Another version is the compound sampler, composed of four coring units, or multiples of four which allows the collection of several parallel cores in a short time and is useful for gathering data on spatial distribution of bottom fauna. The third version provides an exchangeable lower tube attached to the standard sampler by a bayonet holder. This tube may exceed 50 cm in length. Undisturbed cores may be instantly removed much as in the Jenkin sampler but it is a very cheap alternative to the latter. The basic sampler and the compound sampler were compared to Ekman samplers in preliminary tests, and the results were comparable. (Mortland-Battelle)
W72-04715

POLLUTION DETECTION BY REMOTE SENSING.
For primary bibliographic entry see Field 05A.
W72-04726

METHOD FOR THE STORAGE OF SAMPLES FOR DISSOLVED GAS ANALYSES,
Wisconsin Univ., Madison. Water Chemistry Program.
For primary bibliographic entry see Field 05A.
W72-04729

EARTH RESOURCE TECHNOLOGY USED IN POLLUTION DETECTION,
For primary bibliographic entry see Field 05A.
W72-04742

AN ACTIVE METHOD FOR CORRECTING THE FREQUENCY RESPONSE OF THE TEMPERATURE SENSORS OF OCEANOLOGICAL INSTRUMENTS,
Akademiya Nauk SSSR, Moscow. Institut Okeanologii.
V. A. Aranson, and L. V. Belyayeva.
Okeanologiya, Vol 11, No 1, p 126-132, January-February 1971. 8 fig, 3 ref.

Descriptors: *Instrumentation, *Water temperature, *Thermometers, Sea water, Methodology, Analytical techniques, Mathematical studies, Electronic equipment.
Identifiers: d-c amplifiers, Sensors, Response time.

Since temperature sensors which are towed at sea are exposed to large and sometimes rapid temperature fluctuations, it is necessary that response time constants, which are generally of the order of 0.1-0.5 seconds, be decreased. This is possible by using d-c operational amplifiers to correct the output voltage which is obtained by converting the sensor resistance to output voltage. This method was applied to sensor circuits employing KMT-14 thermistors and UU-2 amplifiers. Tests of the modified sensor circuits showed that the response lag time was improved by a factor of 8-10. Detailed mathematical analysis of the correction method is included. (Holoman-Battelle)
W72-04749

PHOTOGRAPHIC METHOD FOR SURVEYING CLAM POPULATIONS,
Maryland Univ., Prince Frederick. Natural Resources Inst.
A. J. McErlean, and Jack Howard.
Proc Nat Shellfish Ass. 61: 91-94. Illus. 1971.
Identifiers: Clam, Method, Mya-arenaria, Photographic, Populations, Surveying.

A photographic method for surveying softshell clam, Mya arenaria beds is described and evaluated. The equipment, which includes an underwater camera affixed to an aluminum frame, is diver-operated and positioned during sampling. Some preliminary results concerning spacial arrangements in juvenile and adult beds are discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-04750

AN AUTOMATIC BRINE SHRIMP FEEDER,
Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.
Emory D. Anderson, and Lloyd L. Smith, Jr.
Progr Fish-Cult. 33 (2): 118-119. Illus. 1971.
Identifiers: Artemia-spp, Automatic, Brine, Coregonus-artedii, Feeder, Shrimp.

An automatic feeder that provides continuous feeding on live brine shrimp (Artemia spp.) to lake herring (Coregonus artedii) larvae at regular and frequent intervals during extended periods is described. The size of the feeder, cycle frequency, and volume delivered can be varied. The feeder operates by means of a constant-flow siphon that has as its source a 5-gal jug containing the brine solution.--Copyright 1971, Biological Abstracts, Inc.
W72-04751

SPACE-TIME SAMPLING OF ECOLOGICAL SYSTEMS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 06A.
W72-04779

ANALYSIS OF COFFEE, TEA AND ARTIFICIALLY FLAVORED DRINKS PREPARED FROM MINERALIZED WATERS,
California Univ., Davis. Dept. of Food Science and Technology.
Rose Marie Pangborn, Ida M. Trabue, and Angela C. Little.
J Food Sci. 36 (2): 355-362. 1971. Illus.
Identifiers: Artificially, Coffee-D, Drinks, Flavored, Grape-D, Mineralized, Orange-D, Prepared, Tea-D.

Coffee, Black Tea and artificially flavored and artificially sweetened orange and grape soft drinks were prepared from solutions of 8 minerals each at 750 ppm. Additionally, coffee and tea were brewed, using 6 natural drinking waters which ranged from 42-1, 725 ppm of total dissolved

solids. Beverages made from solutions containing carbonates were the least desirable, having flat, insipid characteristics. Although distilled water resulted in an acceptable soft drink, coffee and tea prepared from it were excessively sour and astringent, respectively. The recommended formula of 53.3 g of coffee per liter of water was considered too strong and 'burnt' for the panel of trained judges, so that the experiments were repeated at a lower concentration of 47 g coffee/liter water. Large differences in the direction and magnitude of the visual characteristics of the coffee and tea brewed from the various waters also were observed in the marked changes in luminous transreflectance, purity and shifts in dominant wavelengths measured by thin-layer reflectometry.--Copyright 1971, Biological Abstracts, Inc.
W72-04782

THERMAL MAPPING OF SELECTED SITES IN THE LAKE KINNERET REGION,
Tel Aviv Univ. (Israel). Dept. of Environmental Sciences.
J. Otterman, A. Kahanonwitz, and R. Shilo.
Israel Journal of Earth-Sciences, Vol 20, No 3, p 89-95, 1971. 6 fig, 1 ref.

Descriptors: *Water temperature, *Data collections, *Remote sensing, *Infrared radiation, *Thermal radiation, Mapping, Groundwater, Surface waters, Instrumentation, Analytical techniques, Thermal water.
Identifiers: *Sea of Galilee Area.

A technique of thermal mapping is described for use in studies of water resources. The AGA Thermovision Model 661 (infrared television system) was used to obtain thermal imagery of ground areas and water bodies around the Sea of Galilee (Lake Kinneret). The areas were: (a) offshore regions of the lake, where warm springs come to the surface; (b) the eastern slopes of Mt. Herod, south of Tiberias; (c) the area of the main thermal springs of Tiberias (Hammei Tveria). Although the mapping was limited, since only a ground-based instrument was available, some interesting observations were made. A practical method is described for locating and observing the flow of hot springs on the surface of Lake Kinneret. (Woodard-USGS)
W72-04811

RESULTS OF A FIELD STUDY USING THE 3-AXIS DOPPLER SHIFT CURRENT METER,
John Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 02L.
W72-04817

THE CHESAPEAKE BAY INSTITUTE WAVE FOLLOWER--PART II,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
M. Peep, and R. J. Flower.
Chesapeake Bay Institute Technical Report 73 (Reference 71-8), Johns Hopkins University, September 1971. 53 p, 28 fig, 3 tab, 8 ref, append. Contract NR 083-016. Contract N00014-67-A-0163-0006 (ONR).

Descriptors: *Oceanography, *Ocean waves, *Anemometers, *Data collections, *Instrumentation, Hydrologic data, Winds, Turbulence, Remote sensing, Electronic equipment, Testing.
Identifiers: *Wave follower, Wave probe.

An electrohydraulic wave follower has been designed and laboratory tested. The instrument holds a hot-film or hot-wire anemometer probe at various distances (fixed or variable) above and close to the moving sea surface. Two field trips were made in 1969 to check its mechanical and electrical performance and to obtain wind and wave records. Analysis of the records shows that: (1) the follower's response to the sea surface is characterized by a time constant of 1/30 sec, (2) its tracking error is 0.03 cm per cm/sec vertical velocity, or, typically, with 4 cm (rms) waves the error was 0.6 cm (rms), (3) the follower's useful frequency response is 5-6 Hz, (4) waves are reported up to 10 Hz, (5) wind speed is reported up to 40 Hz, and (6) sample cross spectra are computed between wind and waves, and follower response and the sea surface. Lab tests and calculation show the follower's tracking error can be reduced by a factor of three at the most if the present feedback configuration is used. The limit is the servo valve; wave probes have been designed to respond to over 10 Hz. (Woodard-USGS)
W72-04818

THERMAL STUDY OF THE MISSOURI RIVER IN NORTH DAKOTA USING INFRARED IMAGERY,
Geological Survey, Bismarck, N. Dak.
For primary bibliographic entry see Field 05B.
W72-04824

RESISTIVITY SOUNDINGS IN THE CONDROZ (BELGIUM) WITH SCHLUMBERGER AND DIPOLE ARRAYS; APPLICATION TO LIMESTONE AQUIFER EVALUATION,
Ghent Rijksuniversiteit (Belgium). Geologisch Instituut.
For primary bibliographic entry see Field 02F.
W72-04850

STRUCTURAL MEASUREMENTS WITH HOLOGRAPHIC INTERFEROMETRY,
Aerojet Nuclear Systems Corp., Sacramento, Calif.
For primary bibliographic entry see Field 08A.
W72-04865

HYDROMETEOROLOGY IN PRECIPITATION MANAGEMENT,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 06B.
W72-04866

CRITICAL-DEPTH FLUMES FOR DETERMINING FLOW IN CANALS AND NATURAL CHANNELS,
Agricultural Research Service, Phoenix, Ariz.
For primary bibliographic entry see Field 08B.
W72-04871

LASER HOLOGRAPHY AND INTERFEROMETRY IN MATERIALS RESEARCH,
Bell Telephone Labs., Inc., Murray Hill, N.J.; and Bell Telephone Labs., Inc., Whippany, N.J.
T. D. Dudderar, and R. O'Reagan.
Materials Research and Standards, Vol 11, No 9, p 8-15, Sept 1971. 4 fig, 59 ref.

Descriptors: Static tests, Dyanmic tests, Loads (Forces), Analysis, Interference, Fractures, Metrology, Nondestructive tests, Fatigue e4sts, Deformation, Displacements, *Materials tests, Microscopy, Bibliographies.
Identifiers: *Holography, Schematic diagrams, *Interferometers, *Lasers, *Optical measurement, Interference analyzers.

The development and application of laser holography to interferometry has extended the usefulness and versatility of this optical measuring technique. The hologram is used to store a detailed optical replica of a test specimen which can be reconstructed whenever needed. Because the hologram contains both amplitude and phase information, the reconstruction process yields a comparison light wave front indistinguishable from the original wave front and ideally suited to interferometry. Consequently, combination with subsequent light wave fronts from the distrubed specimen yields full field interference patterns directly related to the extent of that disturbance. Because only changes in the wave front are involved in the interference process and special specimen design and preparation are not required, the geometry of the test specimen can be complicated arbitrarily to suit the application. Many practical applications of this sensitive technique to both static and dynamic tests of transparent and opaque test materials have been demonstrated. Holographic interferometry can be used for the quantitative evaluation of material response to applied mechanical or thermal loadings, the nondestructive detection of small flaws or cracks, and for fatigue damage. (USBR)
W72-04873

ADVANCES IN THE CONTINUOUS CULTURE OF PLANKTONIC COPEPODS,
National Marine Water Quality Lab., West Kingston, R.I.
For primary bibliographic entry see Field 05A.
W72-04900

A CORE SAMPLER FOR SEMI-FLUID SUBSTRATES,
British Columbia Univ., Vancouver. Inst. of Animal Resources and Ecology.
R. L. Kitching.
Hydrobiologia. 37 (2): 205-209. 1971. Illus. Spanish summary.
Identifiers: Auger, Core, Fluid, Holes, Mechanism, Sampler, Substrates, Tree.

A core sampler developed for use in sampling water-filled tree-holes is described. This apparatus consists of an auger mechanism that fits inside the conventional corer tube. Its construction is simple and inexpensive and the resulting instrument is both portable and easy to use.--Copyright 1971, Biological Abstracts, Inc.
W72-05008

RECURRENCE RELATIONS FOR FIRST ORDER SEQUENTIAL REACTIONS IN NATURAL WATERS,
Manhattan Coll., Bronx, N.Y. Environmental Engineering and Science Program.
For primary bibliographic entry see Field 05B.
W72-05027

WIRE-GUIDED SELF-PROPELLED WATER SAMPLER.
National Ocean Survey, Washington, D.C.

National Oceanographic Instrumentation Center Technical Bulletin DE-1002, p 1-4, December 1971. 4 fig, 1 tab.

Descriptors: *Water analysis, *Sampling, *Instrumentation, *Oceans, Research and development, Design, Design data, Design standards, Data collections.
Identifiers: *Water sampler.

An investigation was conducted by the National Oceanographic Instrumentation Center to determine the conceptual feasibility of a wire-guided, self-propelled water sampler as a field standard. Basically, the prototype is constructed as a messenger which rides a guide wire. The assembly is negatively buoyant when launched and descends on the guide wire until an obstruction is encountered (i.e., the moored sensor) when the piston release mechanism disengages the positively buoyant afterbody from the negatively buoyant nose cone. The afterbody then ascends the guide wire to the surface. This concept of a wire-guided unpowered device for deep-water sampling shows promise since average velocities of 5 ft/sec were achieved in the field. The depth capabilities are limited only by the strength-buoyancy ratio of the flotation material. (Woodard-USGS)
W72-05042

A NOTE ON INEXPENSIVE TELEMETRY OF RIVER SEDIMENT CONCENTRATIONS,
Natal Univ., Pietermaritzburg (South Africa).
W. James, and G. D. Finlayson.
International Association of Scientific Hydrology Bulletin, Vol 16, No 2, p 87-90, June 1971. 2 fig, 2 ref, append.

Descriptors: *Instrumentation, *Turbidity, *Telemetry, *Suspended load, *Sediment load, Sediments, Rivers, Sediment transport, Sedimentation, Current meters.

An extensive method for continuous telemetry and monitoring of suspended sediment concentrations in rivers was recently developed at the University of Natal. The instrument uses solid state electronic circuitry and was thoroughly laboratory-tested. The circuitry and the operation of the instrument are described. (Knapp-USGS)
W72-05049

ESCA--THE NEW SPECTROSCOPY,
Waterloo Univ. (Ontario). Dept. of Chemistry.
For primary bibliographic entry see Field 02K.
W72-05051

ECONOMICAL RADIOMETER THEORY, PERFORMANCE AND CONSTRUCTION,
Wisconsin Univ., Madison. Coll. of Agricultural and Life Sciences.
For primary bibliographic entry see Field 02D.
W72-05081

RADIOCARBON IN NATURE,
Council for Scientific and Industrial Research, Pretoria (South Africa). National Physical Research Lab.
J. C. Vogel.
S Afr J Sci. 67 (2): 32-42. 1971. Illus, Map.
Identifiers: Carbon, Nature, Radio.

Of the cosmic ray produced radioactive isotopes radiocarbon has found the most widespread application - not only for dating fossil organic material, but also in studies of atmospheric and oceanographic mixing processes, ground water flow etc. The recent large increase in the atmospheric radiocarbon content caused by nuclear weapon tests had provided further possibilities for investigating these mixing phenomena. With radiocarbon dating an absolute time-scale has been set up for the last Ice Age and the development of the human race during this period. Small fluctuations in the radiocarbon level in the more recent past have somewhat complicated the precise determination of events during this period, but careful application of the new information gives good results for the protohistoric period in South Africa.--Copyright 1971, Biological Abstracts, Inc.
W72-05110

A SIMPLE WETNESS RECORDER,
Reading Univ. (England). Dept. of Horticulture.
P. A. Huxley, and J. M. Waller.
Exp Agric. 7 (3): 205-212. 1971. Illus.
Identifiers: Dew, Dye, Plant, Recorder, Sensor, Wetness.

When wetted overnight by dew, dye spots on a cone-shaped paper 'sensor' will spread to an extent which depends on both the duration and the intensity of dewfall. Results from such a sensor have been compared with those from the de Wit recorder. Although only a qualitative assessment of surface wetness is obtained, the paper sensors are cheap and easily replicated, they can be stored for assessment later and they can be made in sizes to suit any particular situation in the field.--Copyright 1971, Biological Abstracts, Inc.
W72-05152

EXPERIMENTAL STUDY OF THE FORMATION OF A POPULATION ON LOOSE GROUND FROM MEROPLANKTONIC LARVAE, (IN FRENCH),
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.
J. P. Guerin.
Cah Biol Mar. 11: 167-185. 1970. Illus. Map. English summary.
Identifiers: Formation, Ground, Lamellibranchs, Larvae, Mero, Planktonic, Polychaeta, Population.

An apparatus is completed for the study--in situ--of polychaeta and lamellibranchs larvae settlement. This apparatus includes 2 parts; a frame, anchored definitively on the bottom, at a depth of 5 m, and 6 removable collectors, where the experiment of settlement takes place. For this purpose, each collector contains 260 cm3 of sand previously sieved to separate its macroscopic population. Ecology and description of the polychaetes and lamellibranchs are discussed.--Copyright 1971, Biological Abstracts, Inc.
W72-05256

AN EMPIRICAL METHOD FOR DETERMINING THE CONCENTRATION OF SOLIDS IN SUSPENSION,
American Standard Inc., New Brunswick, N.J.
For primary bibliographic entry see Field 05A.
W7204731

7C. Evaluation, Processing and Publication

A TECHNIQUE FOR ENUMERATING KOKANEE SALMON (ONCORHYNCHUS NERKA) FRY MIGRATING THROUGH STREAMS, WITH AN APPENDIX FOR PROCESSING CATCH DATA BY IBM 360 FORTRAN IV. COMPUTER PROGRAMS,
British Columbia Dept. of Recreation and Conservation, Victoria. Fish and Wildlife Branch.
A. H. Acara, and H. D. Smith.
J Fish Res Bd Can. 28 (4): 573-585. 1971. Illus.
Identifiers: Appendix, Catch, Computer, Enumerating, Fortran, Fry, IBM-360, Kokanee, Mathematical, Migrating, Model, Oncorhynchusnerka, Processing, Programs, Salmon, Streams, Technique.

A technique for enumerating O. nerka fry migrating downstream was developed in Meadow Creek (a tributary to the Duncan River and Kootenay Lake, British Columbia) and was used to obtain an estimate of 10.06 million kokanee fry in 1968. The hyperbolic relation between the nightly mean catch per net per minute (C) and nightly probable error (E) as the percent of the nightly total was expressed by log E = -0.5703-0.4568 log C; E was largest at the beginning and end, and smallest at the peak of fry migration. E was also calculated as the percent of the seasonal total, and in 1968 was plus or minus 5.8%. Of this total, plus or minus 0.7% was accumulated during April, when 6.4% of the migration occurred; plus or minus 3.9% was accumulated in May, when 82.2% of the migration occurred; and the final plus or minus 1.2% was accumulated in June, when 11.2% of the migration occurred. The variability in abundance of fry and spacing of groups of fry are considered to be the most important factors controlling the magnitude of error. Some aspects of migratory behavior of kokanee fry in Meadow Creek were revealed and their effects on estimates of abundance are discussed. A series of IBM 360 Fortran IV computer programs for processing catch data are also given in an appendix.--Copyright 1971, Biological Abstracts, Inc.
W72-04752

RECORDS OF WELLS, DRILLERS' LOGS, AND CHEMICAL ANALYSIS OF GROUND WATER IN GALVESTON COUNTY, TEXAS 1952-1970,
Geological Survey, Austin, Tex.
For primary bibliographic entry see Field 04B.
W72-04795

INVERSE SOLUTIONS TO THREE-DIMENSIONAL FREE SURFACE POTENTIAL FLOWS,
Utah State Univ., Logan. Coll. of Engineering.
For primary bibliographic entry see Field 02F.
W72-04808

HYDROLOGIC DATA FOR HORSESHOE LAKE, ARKANSAS, AND VICINITY,
Geological Survey, Little Rock, Ark. Water Resources Div.
A. G. Lamonds.
Geological Survey Open-file Report, 1971. 36 p, 1 plate, 7 tab.

Descriptors: *Hydrologic data, *Data collections, *Groundwater, *Surface waters, *Arkansas, Water wells, Water levels, Observation wells, Logging (Recording), Lakes, Water temperature, Pumping, Water yield.
Identifiers: *Horseshoe Lake (Ark).

Hydrologic data of Horseshoe Lake, Arkansas include measurements of water levels in 56 wells, lithologic logs of 11 wells and test holes, elevations of the water surface in Goose and Brushy Lakes, elevation of the water surface in Fish Bayou, and the average daily water temperature at Horseshoe Lake. The data were collected from July 1969 to May 1971. All wells and points of interest are numbered by a location system based on the Federal land-survey system used in Arkansas. The component parts of a well or location number are the township number, the range number, the section number, and three lowercase letters that indicate the quarter section, the quarter-quarter section, and the quarter-quarter-quarter section in which the well or point of interest is located. (Woodard-USGS)
W72-04822

VOLUMETRIC, AREAL, AND TIDAL STATISTICS OF THE CHESAPEAKE BAY ESTUARY AND ITS TRIBUTARIES,
Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
For primary bibliographic entry see Field 02L.
W72-04838

RECORDS OF WELLS, SPRINGS, AND TEST BORINGS, CHEMICAL ANALYSES OF WATER, SEDIMENT ANALYSES, STANDARD STREAMFLOW DATA SUMMARIES, AND SELECTED DRILLERS' LOGS FROM THE LITTLE KANAWHA RIVER BASIN IN WEST VIRGINIA,
Geological Survey, Charleston, W. Va. Water Resources Div.
E. A. Friel, and G. L. Bain.
Geological Survey Basic Data Report No 2, 1971. 76 p, 4 fig, 12 tab.

Descriptors: *Hydrologic data, *Data collection, *Surface waters, *Groundwater, *West Virginia, Water quality, Water yield, Streamflow, Stream gages, Flow rates, Water wells, Aquifers, Hydrogeology, Sediment transport, Sedimentation, Chemical analysis, Water analysis, Water levels, Surface-groundwater relationships.
Identifiers: *Little Kanawha River Basin (W Va).

Basic data are presented for the water resources (surface water and groundwater) of the Little Kanawha River basin in West Virginia. Most of the basic data were obtained during the period 1966-1969. Included are summaries of water-bearing properties of the principal rock units underlying the Little Kanawha basin, laboratory and field chemical analyses of surface-water samples, instantaneous suspended sediment analyses at stream-gaging stations, streamflow records of daily discharge for each station, and well drillers' logs. (Woodard-USGS)
W72-04841

THE ANNUAL TEMPERATURE REGIME OF A SMALL STREAM IN NEW ZEALAND,
Marine Dept., Wellington (New Zealand). Fisheries Research Div.
For primary bibliographic entry see Field 02E.
W72-04987

HYDROLOGIC DATA FOR THE SAN LUIS VALLEY, COLORADO,
Geological Survey, Denver, Colo.
P. A. Emery, R. J. Snipes, and J. M. Dumeyer.
Colorado Water Conservation Board, Denver, Basic-Data Release No 22, 1972. 146 p, 3 fig, 1 plate, 10 tab.

Descriptors: *Water resources development, *Groundwater, *Hydrogeology, *Colorado, *Hydrologic data, Water levels, Aquifer characteristics, Water yield, Water quality, Chemical analysis, Withdrawal, Water wells, Water users, Data collections, Surface-groundwater relationships.
Identifiers: *San Luis Valley (Colo).

Presented in one plate, three figures, and 10 tables are the basic hydrologic data collected from July 1966 to July 1970 and selected data collected during previous studies for the San Luis Valley (area 3,200 sq mi) in Colorado. The aquifers consist of unconsolidated clay, silt, sand, gravel, and interbedded volcanic rocks. At least 2 billion acre-feet of water is stored in the valley-fill deposits. The water occurs in two major aquifer systems referred to as the uncondined and confined (artesian) aquifers. These aquifers are separated by a 'clay series' or by an upper layer of volcanic rocks. Records of 2,919 irrigation wells and 18 municipal wells are included. A network of 334 observation wells was established to monitor water-level changes and provide data for hydrologic maps. Chemical analyses of 218 samples from the unconfined aquifer and 198 samples from the confined aquifer are presented. Miscellaneous flow measurements were made of many streams and springs in order to determine the surface-water inflow to the valley. (Woodard-USGS)
W72-05025

HYMO, A PROBLEM-ORIENTED COMPUTER LANGUAGE FOR BUILDING HYDROLOGIC MODELS,
Agricultural Research Service, Riesel, Tex. Soil and Water Research Div.
J. R. Williams, and R. W. Hann.
Water Resources Research, Vol 8, No 1, p 79-86, February 1972. 1 fig, 1 tab, 13 ref.

Descriptors: *Programming languages, *Computer programs, *Mathematical models, *Rainfall-runoff relationships, *Routing, Flood routing, Model studies, Systems analysis, Stage-discharge relations, Hydrographs.
Identifiers: Computer languages, Hymo.

Hymo is a computer language which can be used to great advantages in watershed modeling. Twelve commands, commonly used in hydrology, transform rainfall into runoff hydrographs and route these hydrographs through streams and valleys or reservoirs. These functions make Hymo quite useful in the design and evaluation of flood control structures, flood forecasting, and research studies. The procedures used in Hymo were selected because of their accuracy, simplicity, and practicality. The input data required for Hymo are normally available for most watersheds. Hymo is quite flexible in that hydrologists familiar with Fortran 4 programming can easily add new commands or modify the present commands. (Knapp-USGS)
W72-05028

A COMPUTERIZED EDUCATIONAL PROGRAM FOR THE APPLICATION OF THE MANAGEMENT SCIENCES TO WATER RESOURCE MANAGEMENT,
Massachusetts Univ., Amherst. Water Resources Research Center.
Eugene E. Kaczka, and George F. Williams.
Available from the National Technical Information Service as PB-207 136, $3.00 in paper copy, $0.95 in microfiche. Completion Report 7 FY72-6, June 1971. 25 p, 3 tab, 68 ref, append. OWRR A-029 MASS (1).

Descriptors: *Systems analysis, *Education, *Operations research, *Water management (Applied), Model studies, *Computer programs.

A computerized, educational program treating operations research and systems analysis applications in water resources was developed for students and administrators in water resources. Topics in the program are selected from the current applications in water resources research and administration. Criteria for evaluating existing computer models are delineated. Based upon the criteria, few existing models can be readily adapted to instructional use. The alternative of incorporating the essential model features in a new program allows expansion of the set of models utilized in the program. Four models for instructional use are described.
W72-05088

NUMERICAL MODELING OF UNSATURATED GROUNDWATER FLOW INCLUDING EFFECTS OF EVAPOTRANSPIRATION,
Kansas Water Resources Research Inst., Manhattan.
For primary bibliographic entry see Field 02G.
W72-05089

WATER RESOURCES DATA FOR WISCONSIN, 1969: PART L. SURFACE WATER RECORDS, AND PART 2. WATER QUALITY RECORDS.
Geological Survey, Madison, Wis. Water Resources Div.

Available from Dist Chief, USGS, 1815 University Ave., Madison, Wis. 53706. US Geological Survey Basic Data Report, 1971. 253 p, 5 fig, 20 ref.

Descriptors: *Surface waters, *Flow measurement, *Water quality, *Data collections, *Wisconsin, Hydrologic data, Streamflow, Gaging stations, Average flow, Low-flow, Peak discharge, Lakes, Reservoirs, Chemical analysis.

Water resources data are presented for the 1969 water year for Wisconsin including records of streamflow or reservoir storage at gaging stations, partial-record stations, and miscellaneous sites, and records of water-quality data on the chemical and physical characteristics of surface water. Records for a few pertinent gaging stations in bordering States are included. The tables of data for gaging stations show the daily, monthly, and yearly discharges of the stream. The description of the station gives the location, drainage area, records available, type and history of gage, average discharge, extremes of discharge, and general remarks. For most gaging stations on lakes and reservoirs the data presented comprise a description of the station and a monthly summary table of stage and contents. Data for partial-record stations are presented in two tables: (1) discharge measurements at low-flow partial-record stations; and (2) annual maximum stage and discharge at crest-stage stations. (Woodard-USGS)
W72-05094

PRECIPITATION DATA AND ANALYSIS--VOLUME I, VENEZUELAN INTERNATIONAL METEOROLOGICAL AND HYDROLOGICAL EXPERIMENT (VIMHEX) HYDROLOGY REPORT,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
D. B. Simmons, E. V. Richardson, M. A. Stevens, J. H. Duke, and V. C. Duke.
Colorado State University Report (CER70-71DBS-EJR-MAS-JHD-VCD-HR50), May 1971. 424 p, 12 fig, 27 tab.

Descriptors: *Precipitation (Atmospheric), *Rainfall, *Tropical regions, *Meteorological data, *Data collections, Isohyets, Rainfall intensity, Rain gages.
Identifiers: *Venezuela.

VIMHEX is an intensive program of tropical meteorological and hydrological observations taken in northeast Venezuela during the summer of 1969 to support a study of tropical atmospheric physics and the resulting effects of rainfall. The meso-scale weather structure is expressed in terms of the synoptic-scale envelope, and the ground response is formulated to the rainfall produced by tropical weather disturbances over relatively flat tropical topography. The Volume I Hydrology Report lists the precipitation data collected during the summer of 1969 including hourly rainfall, longer period isohyetal maps, and weekly and monthly average precipitations. For the summer months of July, August, and September an average of 4.8 mm of precipitation per day fell on the drainage basins. (See also W72-05096) (Woodard-USGS)
W72-05095

STREAMFLOW, GROUNDWATER AND GROUND RESPONSE DATA--VOLUME II, VENEZUELAN INTERNATIONAL METEOROLOGICAL AND HYDROLOGICAL EXPERIMENT (VIMHEX) HYDROLOGY REPORT,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
D. B. Simons, E. V. Richardson, M. A. Stevens, J. H. Duke, and V. C. Duke.
Colorado State University Dept. of Civil Engineering Report (CER70-71DBS-EVR-MASJHD-VCD-50), August 1971. 356 p, 6 fig, 6 ref.

Descriptors: *Surface-groundwater relationships, *Tropical regions, *Hydrologic data, *Data collections, Streamflow, Stream gages, Flow measurement, Flow rates, Sediment transport, Particle size, Water wells, Observation wells, Water levels, Water quality, Chemical analysis, Groundwater recharge, Soil moisture, Infiltration.
Identifiers: *Venezuela.

VIMHEX is an intensive program of tropical meteorological and hydrological observations taken in northeast Venezuela during the summer of 1969 to support a study of tropical atmospheric physics and the resulting effects of rainfall. The meso-scale weather structure is expressed in terms of the synoptic-scale envelope, and the ground response is formulated to the rainfall produced by tropical weather disturbances over relatively flat tropical topography. Volume II Hydrology Report is a compilation of the data obtained on streamflow, groundwater, and ground response in the VIMHEX study area during the summer of 1969. Included are 2-hourly streamflow and mean daily discharge records at 25 river discharge gaging stations; measured suspended sediment at 4 river locations; river bed-material size analyses at 30 locations; river bank-material descriptions; groundwater levels for 38 wells; chemical analysis for various discharges at selected river stations; soil moisture content at 4 locations; infiltration test results and soil descriptions for various areas in the drainage basins; and soil temperature data at 1 station. (See also W72-05095) (Woodard-USGS)
W72-05096

MODELLING OF POPULATIONS AND COMMUNITIES OF AQUATIC ANIMALS ON DIGITAL COMPUTERS (IN RUSSIAN),
Akademiya Nauk SSSR, Leningrad. Institut Evolyutsionnoi Fiziologii i Biokhimii.
For primary bibliographic entry see Field 02H.
W72-05175

08. ENGINEERING WORKS

8A. Structures

STRUCTURAL MEASUREMENTS WITH HOLOGRAPHIC INTERFEROMETRY,
Aerojet Nuclear Systems Corp., Sacramento, Calif.
R. C. Sampson.
Materials Research and Standards, Vol 11, No 9, p 26-31, Sept 1971. 15 fig, 1 tab, 4 ref.

Descriptors: *Stress analysis, *Deformation, *Structural analysis, Dead loads, Dynamic loads, Vibration, Measuring instruments, Resonance.
Identifiers: *Holography, Interferometers, Deformation meters, Use potential.

Holographic interferometry is a structural analysis tool used to meausre deformation and displacement in materials and structures. The method provides a whole-field contour map of a structurally significant parameter. Holography excels in applications to small displacements of surfaces having arbitrary contour and finish, and subjected to static, dynamic or steady state oscillatory motion. Examples of various loadings in specific structures are given. Advantages of the holographic method are: (1) freedom from influence of the measuring system on the measured object, (2) no exacting requirements for specimen surface preparation, (3) whole-field surface displacement data at low cost, and, (4) detailed resolution of very small out-of-plane displacement fields in static or oscillatory motion. The method has some limitations and is presently restricted to small displacements, is less adaptable to inplane displacement measurements than to out-of-plane motions, and must be isolated from an environment that includes excessive vibration, nonsteady temperature gradient, or stray light. (USBR)
W72-04865

THE EFFECTS OF ELECTROKINETICS UPON INCRUSTATION IN WATER WELLS,
Nebraska Univ., Lincoln.
T. C. Mandal, and D. M. Edwards.
Transactions, American Society of Agricultural Engineers, Vol 14, No 3, p 442-444, May-June 1971. 6 fig, 6 ref.

Descriptors: *Water wells,. Laboratory tests, Aquifer model, *Well screens, Corrosion, Electric potential, Electrokinetic potential, Direct current, Irrigation wells, Groundwater.
Identifiers: Well failures, *Electrokinetics, *Incrustation.

A new appraoch based on electrokinetic theory was studied to determine the underlying causes of incrustation on water wells. When water flows through a porous media by a pressure differential, a streaming potential is generated. This voltage may cause incrustation. If the electrokinetic theory is correct, then the streaming potential could be counteracted by a direct-current voltage of opposite polarity. Objectives of this study were to determine: the magnitude of the streaming potential in a saturated water-bearing sand aquifer, the relationship between the acquifer streaming potential and incrustation on the well screen, and whether incrustations on the well screen could be eliminated by applying a direct-current voltage into the aquifer. A laboratory study of simulated field conditions showed: (1) a saturated water-bearing aquifer generates a streaming potential, (2) the streaming potential is a catalyst in forming the incrustations, (3) incrustations form on the well screen only when the screen is negatively charged, (4) no deposits form on the screen when it is positively charged, and (5) a direct-current voltage imposed into the acquifer should prevent incrustations on a well screen in field installations. (USBR)
W72-04870

8B. Hydraulics

FLOW OVER ROUNDED SPILLWAYS,
Liverpool Univ. (England). Dept. of Civil Engineering.
K. H. M. Ali.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 98, HY 2, Paper 8704, p 365-380, February 1972. 9 fig, 3 tab, 14 ref, append.

Descriptors: *Spillway crests, *Spillways, *Discharge (Water), Hydraulics, Stage-discharge relations, Velocity.
Identifiers: Rounded spillways.

Using a condition necessary for irrotational flow, a simple solution was obtained for the flow over round-crested spillways. Additional assumptions were that the streamline curvature varied linearly from top to bottom and that the equipotential normals were either parabolic or cubic. The upper nappe profiles were closely fitted by cubic equations. The resulting approximate theory agrees well with experimental results. (Knapp-USGS)
W72-04809

CRITICAL-DEPTH FLUMES FOR DETERMINING FLOW IN CANALS AND NATURAL CHANNELS,
Agricultural Research Service, Phoenix, Ariz.
J. A. Replogle.
Transactions, American Society of Agricultural Engineers, Vol 14, No 3, p 428-433, 436, May-June 1971. 3 fig, 9 tab, 16 ref.

Descriptors: *Flow, Bibliographies, *Water measurement, *Critical depth, *Flumes, *Flow measurement, Canals, Hydraulic design, Laboratory tests.
Identifiers: *Critical depth.

Many flow measuring flumes cause critical discharge to occur in a region of curvilinear flow. Flexibility of use is inhibited because discharge rates in these flumes generally cannot be predicted by conventional theories, but require a laboratory rating for each flume size. Critical-depth flumes can be proportioned so that the flow conditions can be determined by rigorous mathematical analysis, and the flumes designed by computer. Although conformance to standard sizes is unnecessary, 42 sizes are given for measuring discharges for 7 standard slip-formed canal sections. The flumes are designed to avoid the submerged-flow range. Construction criteria are not rigorous; dimensional accuracy in the throat section of the flume should approximate that desired in the resulting discharge rate, while all other dimensions can be plus or minus 10%. Although other measuring devices may be less expensive, critical-depth flumes have the following advantages: (1) low obstruction to suspended and bedload solids, (2) experimental calibration is not required, and (3) sufficient accuracy for most applications over a wide range of discharges. (USBR)
W72-04871

A METHOD FOR PREDICTING PEAK FLOWS FROM SMALL RURAL VERMONT WATERSHEDS,
Vermont Univ., Burlington. Dept. of Civil Engineering.
George T. Tucker.
MS Thesis, February 1971. 64 p, 11 fig, 8 tab, 32 ref. OWRR A-008-VT (2).

Descriptors: *Peak discharge, *Vermont, *Small watersheds, *Forecasting, *Watersheds (Basins), *Regression analysis, Agricultural watersheds, Discharge (Water).
Identifiers: Partial area.

A method for estimating peak flows from small rural watersheds is developed to aid the designer in sizing hydraulic structures. Data were obtained from the Agricultural Research Service in Danville, Vermont, in the form of twenty-nine single-peaked hydrographs and two rain gage records. Efforts were made to determine what percentage of the total watershed area contributed to the direct runoff volume of the storm hydrograph. A stepwise multiple regression analysis was performed using hydrologic parameters as the independent variables and partial area as the dependent variable. The resulting equations provided a method of assessing the magnitude of the partial area that contributes to the peak discharge of the storm hydrograph. Peak discharges were determined by applying ten and fifty-year rainfall amounts to the partial areas as determined from the equations. Equations resulting from this analysis provided a method of predicting the peak discharge directly. The results were applied to the two watersheds studied and compared to a frequency analysis of the observed annual peaks. The results were also applied to a small rural watershed in southern Vermont.
W72-04897

ANALYSIS OF TURBULENT PIPE FLOW,
New York Univ., N.Y. School of Engineering and Science.
G. Kleinstein.
Available from NTIS, Springfield, Va 22151 as AD-730 388 Price $3.00 paper copy; 95 cents microfiche. New York University Department of Aeronautics and Astronautics Report NYU-AA-70-12, June 1970. 19 p, 12 fig, 1 tab, 17 ref. USAF Contract AF-AFOSR-67-1062C.

Descriptors: *Pipe flow, *Turbulent flow, *Mathematical studies, *Model studies, *Forecasting, Velocity, Shear stress, Energy, Viscous flow, Reynolds number, Flow characteristics.
Identifiers: *Turbulent pipe flow.

Turbulent pipe flow was considered from a phenomenological point of view dividing the flow into three regions: the wall region, the core region, and the overlap region. Utilizing an extension of Millikan's analysis a unified eddy viscosity was developed which holds everywhere in the pipe. The model leads to good prediction of mean velocity, turbulent shear, turbulent energy production rate, and direct viscous dissipation profiles as measured by Laufer, and good representation of the friction law for a wide range of Reynolds numbers. (Woodard-USGS)
W72-05050

8C. Hydraulic Machinery

CHOKING AND SUPERCAVITATING VALVES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. P. Tullis.
Journal of Hydraulics Division American Society of Civil Engineers, Vol 97, No HY-12, p 1931-1945, December 1971. 9 fig, 10 ref.

Descriptors: *Valves, *Flow rates.
Identifiers: Supercavitation, Choking, Choking valves, Supercavitating valves.

The difference between choked flow and supercavitation in valves is described, and guidelines are given for determining when these conditions will occur and for calculating flow rate and understanding the system response when they do occur. When the mean pressure immediately downstream drops to vapor pressure, a valve chokes. Vibrations, noise, and possible erosion damage reach their peak intensity near choking. Data are presented for estimating the discharge and pressure at which choking will occur. If downstream pressure is further reduced after choking occurs, the vapor pocket below the valve grows and fills the entire pipe for a considerable distance. This condition is called supercavitation. Supercavitation can be inferred by determining that a cavitation parameter (for which an equation

is given) is less than the choking conditions. The length of the vapor pocket cannot be accurately predicted. Without special design features, it is not recommended that a valve be allowed to operate for extended periods in supercavitation. At choking flow, there is a high potential for erosion damage, and operation under this condition is never recommended. (Mortland-Battelle)
W72-04747

INLAND LAKE DREDGING EVALUATION.
Strand (John A.) and Associates, Inc., Madison, Wis.

Wisconsin Department of Natural Resources, Madison, Technical Bulletin No 46, 1970. 68 p, 11 fig, 1 tab, 30 ref, append A, B.

Descriptors: *Dredging, *Lakes, Sediments, Shallow water, Habitats, Fish, Wildlife, Scenery, Costs, Disposal, Hydrologic aspects, Reparian land, Erosion, Bottom sediments, Excavation, Dewatering, Institutions, Economics, Project planning, State governments, Iowa, Michigan, Wisconsin, Water resource development, Mapping, Methodology.
Identifiers: *Dredging equipment, *Lake renewal, Sauerman bucket, Dry land excavation, Underwater dredging, Dustpan dredge, Cutterhead dredge, Hydraulic dredges.

A survey was conducted of 49 relatively small lake-dredging projects in the Great Lakes region inland lakes and ponds to evaluate various considerations of lake dredging, including effect on the total lake environment. Only to a very limited extent has present scientific and technical knowledge of lakes and the lake environment been applied to lake-dredging projects in the past, thus complete cost data are difficult to obtain; consequently only a general estimate is offered. Disposal sites of redged sediments are critical and additional costs may be incurred due to obstructions created by trees, boulders, and refuse. Projects have been sponsored by state and local governments but many local governments are interested in lake renewal. Procedures are suggested for creation of property owners' associations to initiate improvement programs. Sediment characteristics,, hydrological aspects, lake mapping, and bottom sampling are reviewed. Mechanical methods of sediment removal are described in detail and two appendices include a summary of data from a survey of lake dredging projects, and a sample problem showing considerations in the selection of a hydraulic cutterhead dredge. (Jones-Wisconsin)
W72-04778

OIL SPILL CONTAINMENT SYSTEMS.
Federal Water Quality Administration, Edison, N.J. Water Quality Lab.
For primary bibliographic entry see Field 05G.
W72-04826

THE RESPONSE OF SUBSTATION BUS SYSTEMS TO SHORT CIRCUIT CONDITIONS: PART I, II, III,
Shell Development Co., Emeryville, Calif.
J. E. Borhaug.
Institution of Electrical and Electronic Engineers Transactions, Power Applications Systems, Vol PAS-90, No 4, p 1698-1718, July-Aug 1971. 24 fig, 1 tab, 40 ref, disc.

Descriptors: *Bus (Electrical), *Substations (Electrical), Stress analysis, Mathematical models, Test procedures, Magnetic fields, Dynamic stability, Simulation, Computer models, Electrical insulators, Cantilevers, Vibration tests, *Electrical design.
Identifiers: Deflection measurement, Computer-aided design, *Short circuits.

Four proposed methods for the structural design of substation bus systems to withstand short circuit loads are compared for a single, simple element of a substation. These comparisons showed that the continuous, dynamic design method, which treats the distributed mass of each element, is more reliable than methods presently used. This method also provides more economical alternatives for renovating existing substations, where use of the traditional static method often results in high costs. Routine use of the continuous dynamic method is warranted despite its computational complexity. A dynamic analysis of bus structures reacting to the mechanical forces arising from short circuit currents has been developed and programmed, for numerical solution on the IBM 360 computer, and for use in the design of substations. The analysis is based on a well established, continuous method for describing the transverse vibration of slender beams having distributed mass and elasticity, and treats a member of the structural configurations commonly encountered in substations. Comparisons of predicted displacements with published values from tests on 3 full-scale structures illustrate the success of this analysis in predicting dynamic behavior. (USBR)
W72-04862

THE VIBRATIONS OF TRANSMISSION LINE CONDUCTOR BUNDLES,
Salvi S.p.A., Milan (Italy); and Politecnico di Milano (Italy).
R. Claren.
Institution of Electrical and Electronic Engineers Transactions, Power Application Systems, Vol PAS-90, No 4, p 1796-1814, July-August 1971. 17 fig, 2 illus, 9 tab, 3 chart, 14 ref.

Descriptors: *Transmission lines, Transmission (Electrical), *Bundled conductors, *Aeolian vibration, *Mathematical analysis, Foreign research, Damping, Stiffness, Accuracy, Oscillations, Wavelength, Amplitude, Harmonics, *Vibration, Frequency, Distortion (Structural), Electric conductors.
Identifiers: Italy, Dampers, *Analytical method, Eigenvalues, *Spacers, Lagrangian equation.

Vibrations of transmission line conductor bundles are studied. The response of bundled conductors subjected to harmonic exciting forces is investigated for 2-, 3-, and 4-conductor bundles. Spacer characteristics, expressed by the spacer elastic matrix, impose particular types of natural modes. Excessive spacer stiffness causes severe bending strains on the conductor near spacer clamps. The behavior of spacer-dampers is analyzed and a method of optimizing their characteristics is given. An optimum spacer is not defined; however, the concepts given are valid for any type of spacer. (USBR)
W72-04863

INCREMENTAL VOLTAGE UPRATING OF TRANSMISSION LINES,
Westinghouse Electric Corp., East Pittsburgh, Pa.
D. F. Shankle.
Institution of Electrical and Electronics Engineers Transactions, Power Application Systems, Vol PAS-90, No 4, p 1791-1795, July-Aug 1971. 3 fig, 2 tab, 5 ref, append.

Descriptors: *Transmission lines, Electrical design, Economics, Costs, Right-of-way, Power transformers, Electrical insulators, Electrical equipment, Circuit breakers, Electric conductors, *Transmission (Electrical), Design criteria, Cost comparisons, Transmission towers.
Identifiers: *Transmission capacity, Radio interference, Switching surges, Flashover.

Many electric utilities face the problem of expanding transmission systems where new transmission line rights-of-way (ROW) are becoming more costly and difficult to obtain. The alternative of uprating line voltages on existing ROW to increase transmission capacity is reviewed from the technical and economic standpoints. Costs for uprating an existing transmission line are compared with those of building on a new ROW. The broad range of ROW costs and system transmission requirements may make voltage uprating of existing lines economically attractive. An in-depth technical and economic analysis using actual cost and design data is required before deciding to uprate a specific line. (USBR)
W72-04864

SINGLE-STAGE, 500 M HIGH-HEAD REVERSIBLE PUMP-TURBINES AND GENERATOR-MOTORS FOR NUMAPPARA POWER STATION,
Hitachi Ltd., Tokyo (Japan). Hitachi Works.
S. Naganuma.
Hitachi Review, Vol 20, No 7, p 286-293, July 1971. 8 p, 15 fig, 1 tab, 4 ref.

Descriptors: *Pump turbines, Model tests, Cavitation, Turbine runners, Efficiencies, *Pumped storage.
Identifiers: Japan, *Numappara Power Station, Turbine head covers, Generator-motors, *High head, *Reversible turbines, Turbine efficiency, Turbine parts, Thrust bearings, Spural cases.

The world's first high-head, large-capacity powerplant at the Numappara Power Station, Japan, has a combined output of 675,000 kw, and consists of three 500-m (1,650 ft) net head, pump turbine units with 375-rpm generator-motors. The powerplant scheme and problems in developing these high-head, single-stage units are described. Each pump turbine is designed for a maximum total head of 528 m (1,750 ft) when operating as a pump. Generator-motor specifications, including data on the thrust bearing and rotor construction are given. The starting method for 2 of the units will be by pony motors; the third unit will be started in a synchronous starting mode. (USBR)
W72-04867

FIELD TEST RESULTS ON DIAGONAL-FLOW TYPE REVERSIBLE PUMP-TURBINES AND GENERATOR-MOTORS FOR TAKANE NO. 1 POWER STATION,
Hitachi Ltd., Tokyo (Japan). Hitachi Works.
H. Inoue.
Hitachi Review, Vol 20, No 7, p 268-275, July 1971. 14 fig, 2 tab, 6 ref.

Descriptors: *Pump turbines, Field tests, Model tests, Pumped storage, Load rejection, Vibration, Rotors, Stators, Electrical equipment, Thermal expansion, Hydraulic machinery, Machine design, Prototype tests.
Identifiers: Japan, *Reversible turbines, *Generator-Motor, High head, Turbine efficiency, Spinning reserve, Load rejection.

The 88,000-kw (118,000-hp) diagonal-flow type reversible pump turbines at Takane No. 1 Power Station, Japan, are the largest of their kind in the world. The generator-motors are also the largest in terms of thermal capacity of damper windings because reduced voltage starting (about 38%) is used. Field tests of the pump turbine units are described. Operating characteristics of the prototype units are compared with results obtained from previous model tests. Turbine load-rejection and pump input-rejection characteristic curves are given. Reduced voltage starting in the pumping mode is accomplished by using compressed air to depress the water levellin the runner section. Special features of the generator0motor are discussed. Precautions used during installation considered thermal expansion of the machine during operating conditions, thereby maintaining a gap of 2-3 mm between the rotating and stationary parts of the pump turbine. (USBR)
W72-04868

REVERSIBLE PUMP/TURBINES FOR RACCOON MOUNTAIN,
Allis-Chalmers Corp., York, Pa.
H. H. Wirschal.
Paper, Allis-Chalmers, 1971. 11 p, 17 fig, 12 ref.

Descriptors: *Pumped storage, *Pump turbines, Water cooling, *Underground powerplants, Hydraulic machinery, Electric power production, Power transformers, Hydraulic models, Performance tests, Model tests, Reservoir storage, Turbine efficiency, Electric generators, Cavitation, Rotors, Stators.
Identifiers: *Generator-motors, *Reversible turbines, Turbine efficiency, Specific speed, Tennessee Valley Authority, *Raccoon Mountain Plant.

Tennessee Valley Authority's Raccoon Mountain reversible pump turbine units are the world's most powerful pump turbines presently being manufactured and will be put into commercial operation during 1974. Each generator-motor will be rated 425,000 kva, 0.90 power factor when generating, and 540,000 hp, 1.0 power factor as a motor for pumping. The units will operate at 300 rpm, 23,000 volts. The plant near Chattanooga, Tenn will be a pure pumped storate installation with negligible natural inflow into the upper reservoir. The reservoir storage capacity of 36,000 acre-ft will provide water for 20 hrs of continuous generation. The 4 single-stage Francis-type reversible units and associated power transformers will be located in underground caverns. Pump turbine performance characteristics, design data, and model test results are presented. Stator coils and rotor windings of the generator-motors will be water cooled. A static converter starting system which can be switched from unit to unit will be used for starting in the pumping direction. (USBR)
W72-04874

PUMPING SLUDGE LONG DISTANCES,
Potter (Alexander) Association, New York.
For primary bibliographic entry see Field 05D.
W72-05013

AUXILIARY SEWAGE STORAGE SYSTEM FOR TEMPORARILY STORING SEWAGE,
Aerojet-General Corp., El Monte, Calif.
For primary bibliographic entry see Field 05D.
W72-05022

8D. Soil Mechanics

THE LOAD MOVEMENT BEHAVIOR OF LONG PILES,
Sheffield Univ. (England).
T. H. Hanna, and R. H. S. Tan.
Journal of Materials, Vol 6, No 3, p 532-554, Sept 1971. 12 fig, 18 ref, disc.

Descriptors: *Piles (Foundations), Loads (Forces), *Pile foundations, Soil mechanics, Skin friction, Stress, Shear stress, Failure, Compression tests, Uplift resistance, Model tests, *Foundations, Soil strength, Pile driving, Residual stress, Bibliographies.
Identifiers: Deep footings, Skin friction, Pile tests, Pile friction, Stress-strain curves, Tension tests.

Reliable predictions of pile movement under compressive or tensile forces are important. A reliable pile design method requires: (1) a suitable conceptual model of the pile and soil, and (2) the proper load-deformation parameters of the pile and soil. Before developing a theoretical design method, the stresses existing at the soil-pile interface must be carefully examined. The interface stresses around the pile are affected by the method of placement, previous loading history, and soil conditions. Idealized representations of the interface stresses developed under compressive and tensile loads are presented. Several tests were performed on a model pile 2.55 cm diameter and 1.78 m long. The model piles were placed in a vertical position and then sand was slowly placed beneath and around the pile. To vary the initial interface stress conditions, 2 methods of preparation were used: (1) the pile top was held fixed, and (2) the pile was allowed to float. The test load-movement results showed that the load-movement behavior of a pile can be greatly altered by relatively minor factors. Little advancement in pile analysis is likely until stress and strain conditions in both the pile and soil are better understood. (USBR)
W72-04872

8G. Materials

EXPERIMENTAL CATIONIC ASPHALT EMULSION GROUTING,
Bureau of Reclamation, Denver, Colo.
L. R. Gebhart.
Paper, American Society of Civil Engineers Meeting on Environmental Engineering, St Louis, Mo, Oct 1971. 16 p, 3 fig, 2 chart.

Descriptors: *Asphalt, *Grouting, Dams, Emulsions, Lime, Grout curtains, Pumps, *Leakage, *Cement grouts, Emulsions, Powerplants, Shear cracks, Drains, Catalysts, Construction methods, Construction materials.
Identifiers: Asphalt emulsions, *Cationic asphalt, Morrow Point Dam, Colorado, Morrow Point Powerplant.

As the reservoir filled behind Morrow Point Dam, leakage increased around the limits of the cement grout curtain on the left abutment. A short distance downstream, leakage into the underground powerplant drainage tunnel reached 429 gpm. A cationic asphalt emulsion grout, triggered with a hydrated lime slurry, was chosen to plug the large flowing water channels. Several types of pumps were unsatisfactory for injecting the asphalt emulsion into NX-size holes; air-pressurized tanks were more effective. Injection of 10,000 gal of asphalt emulsion reduced leakage into the powerplant drainage tunnel by approximately 65%. The long-term effectiveness of the asphalt emulsion injection was difficult to evaluate because the reservoir was being lowered during the injection and remained low until after the cement grouting. 7,823 sacks of cement were used to grout 3,696 ft of EX-size grout hole. Long strings of asphalt ejected from holes during the asphalt grouting and subsequent cement grouting, indicated that the asphalt residue was plastic rather than hard. After refilling the reservoir, the initial leakage rate of 429 gpm had been reduced to 37 gpm. (USBR)
W72-04869

8I. Fisheries Engineering

BOOM APPLICATOR FOR AQUATIC HERBICIDES,
Colorado Cooperative Fishery Unit, Fort Collins.
Don T. Weber, and Tom G. Powell.
Progr Fish-Cult. 33 (2): 106. Illus. 1971.
Identifiers: Applicator, Aquatic boom, Herbicides.

An inexpensive, portable device for applying aquatic herbicides is constructed from a 30-gal drum. The applicator dispenses an 8-ft-wide swath of herbicide.--Copyright 1971, Biological Abstracts, Inc.
W72-04707

EFFECTS OF SALINITY ON THE SURVIVAL AND GROWTH OF PRE-SMOLT COHO SALMON (ONCORHYNCHUS KISUTCH),
Arizona State Univ., Tempe. Dept. of Zoology.
Robert G. Otto.
J Fish Res Bd Can. 28 (3): 343-349. 1971. Illus.
Identifiers: Coho, Growth, Management, Oncorhynchus-Kisutch, Pre, Salinity, Salmon, Smolt, Survival, Tool.

Salinity tolerance of juvenile O. kisutch increased markedly during the period from approximately 1 1/2 mo. after emergence from the gravel to the onset of the smolt transformation, except for a decline in the fall. In Jan., salinity tolerance ceased to limit dispersal to the sea. The limiting effects of high salinities on survival were less for larger fish than for smaller individuals and were substantially reduced by a period of exposure to dilute salinities. Growth rate, food intake, and gross food conversion efficiency had the highest values at salinities of 5-10 ppt throughout the pre-smolt period. The results are discussed in relation to the feasibility of using saltwater impoundments as a management tool in increasing coho production.--Copyright 1971, Biological Abstracts Inc.
W72-04775

CONSIDERATIONS FOR CONVENTIONAL TROUT HATCHERY DESIGN AND CONSTRUCTION IN PENNSYLVANIA,
Pennsylvania Fish Commission, Bellefonte. Benner Spring Fisheries Research Station.
Keen Buss, and Edward R. Miller.
Progr Fish-Cult. 33 (2): 86-94. 1971.
Identifiers: Construction, Conventional, Design, Hatchery, Mechanization, Pennsylvania, Trout, USA.

A discussion of water supply, hatchery design, aeration requirements, and water characteristics as factors to consider in reducing hatchery costs, increasing trout production, and eliminating a large percentage of labor by making mechanization feasible and possible.--Copyright 1971, Biological Abstracts, Inc.
W72-04934

CHONDROCOCCUS COLUMNARIS DISEASE OF FISHES: INFLUENCE OF COLUMBIA RIVER FISH LADDERS,
Battelle Memorial Inst., Richland, Wash.
For primary bibliographic entry see Field 05B.
W72-04959

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

A COMPUTERIZED EDUCATIONAL PROGRAM FOR THE APPLICATION OF THE MANAGEMENT SCIENCES TO WATER RESOURCE MANAGEMENT,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 07C.
W72-05088

10. SCIENTIFIC AND TECHNICAL INFORMATION

THE IMPACT OF VARIOUS HEAVY METALS ON THE AQUATIC ENVIRONMENT,
Environmental Protection Agency, Denver, Colo. Water Quality Office.
For primary bibliographic entry see Field 05B.
W72-04792

OXYTETRACYCLINE IN FISH CULTURE: A REVIEW,
Bureau of Sport Fisheries and Wildlife, Kearneysville, W. Va.
For primary bibliographic entry see Field 05C.
W72-04933

ANAEROBIC DIGESTION II. THE CHARACTERIZATION AND CONTROL OF ANAEROBIC DIGESTION,
National Institute for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 05D.
W72-04995

BIBLIOGRAPHY OF PRODUCTS DERIVED FROM AQUATIC ORGANISMS.
Coastal Plains Center for Marine Development Services, Wilmington, N.C.
For primary bibliographic entry see Field 05D.
W72-05086

BIBLIOGRAPHY OF AQUACULTURE.
Coastal Plains Center for Marine Development Services, Wilmington, N.C.
For primary bibliographic entry see Field 05C.
W72-05087

ANNALES D'HYDROBIOLOGIE.
Institut National de la Recherche Agronomique: 149, rue de Grenelle, Paris-7.

Identifiers: Annals, Cyprinid, Hydrobiology, Journal, Microbiology, New, Poeciliid, Salmo-Gairdneri.

The issues of the journal Recherches d'-Hydrobiologie continentale (Research on Continental Hydrobiology), which started in 1969, were temporarily irregular, but will now appear every 6 mo. under the tital Annales d'-Hydrobiologie (Annals of Hydrobiology). Publication every 3 mo. is planned for the near future because of the interest shown by both French and foreign authors and readers. Vol. 1, No. 1 contains 5 reports on various aspects of the hydrobiology of cyprinids, poeciliids, Salmo gairdneri Richardson, and guppies. It also contains a paper on the development of physicochemical and microbiological characteristics preceding summer stagnation in a reservoir.--Copyright 1971, Biological Abstracts, Inc.
W72-05251

SUBJECT INDEX

ABUNDANCE RATIO
Hydrogen Isotope Ratios in a Recycling System,
W72-04967 5D

ACCIDENTS
Industrial Spill Control and Pollution Incident Prevention,
W72-05017 5G

ACCLIMATIZATION
Dual Substrate Utilization by Activated Sludge Microflora,
W72-04990 5D

Discussion of 'Toxic Effects of Ammonia Nitrogen in High Rate Digestion',
W72-05016 5D

ACCOMMODATION
Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

ACID MINE WATER
Cost of Reclamation and Mine Drainage Abatement-Elkins Demonstration Project,
W72-05146 5G

ACIDIC SOILS
The Amelioration of Gley and Pseudogley Soils,
W72-04899 2G

ACTIVATED CARBON
Evaluation Criteria for Granular Activated Carbons,
W72-04977 5D

ACTIVATED SLUDGE
Operational Stability of the Extended Aeration Process,
W72-04784 5D

Use of 14C-Glucose to Study Substrate Removal by Activated Sludge,
W72-04970 5D

Design and Operation of an Extended Aeration Plant,
W72-04973 5D

Operation of Conventional Activated Sludge for Maximum Phosphorus Removal,
W72-04978 5D

Identification of Filamentous Microorganisms in Activated Sludge,
W72-04984 5B

Dual Substrate Utilization by Activated Sludge Microflora,
W72-04990 5D

Recent Experiences in Plant-Scale Application of the Settling Tube Concept,
W72-04991 5D

Phosphorus Removal by Luxury Uptake,
W72-05011 5D

ACTIVITY COEFFICIENTS
Potassium Fluoride - A Reference Standard for Fluoride Ion Activity,
W72-04741 5A

ADIPOSE TISSUE
Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

ADMINISTRATION
Public Participation and Environmental Quality,
W72-04839 6A

ADMINISTRATIVE DECISIONS
Administrative Allocation of Water,
W72-04786 6E

Legal Aspects of Water Salvage,
W72-05098 6E

ADMINISTRATIVE LAW
Administrative Allocation of Water,
W72-04786 6E

ADSORPTION
Dieldrin Levels in Fish From Iowa Streams,
W72-04739 5A

Phosphate Equilibria on Stream Sediment and Soil in a Watershed Draining an Agricultural Region,
W72-04774 5C

Evaluation Criteria for Granular Activated Carbons,
W72-04977 5D

Advanced Organics Removal by Pulsed Adsorption Beds,
W72-05005 5D

ADSORPTION CAPACITY
Evaluation Criteria for Granular Activated Carbons,
W72-04977 5D

AEOLIAN VIBRATION
The Vibrations of Transmission Line Conductor Bundles,
W72-04863 8C

AERATION
Operational Stability of the Extended Aeration Process,
W72-04784 5D

Design and Operation of an Extended Aeration Plant,
W72-04973 5D

Effect of Water Table Depth and Flooding on Yield of Millet,
W72-05124 2G

AEROBIC DIGESTION
Operational Stability of the Extended Aeration Process,
W72-04784 5D

AEROSOLS
Coliform Aerosols Emitted by Sewage Treatment Plants,
W72-04711 5D

AFFLUENCE
Where Will All the People Go. How Much Will They Dump When They Get There -- Population Distribution, Environmental Damage, and the Quality of Life,
W72-05123 6B

AGARS
Cultural Estimation of Yeasts on Seaweeds,
W72-04748 5A

AGRICULTURE
Agricultural Pollution of the Great Lakes Basin.
W72-04762 5B

AIR BARRIERS
Oil Spill Containment Systems.
W72-04826 5G

AIR POLLUTION
Coliform Aerosols Emitted by Sewage Treatment Plants,
W72-04711 5D

Toughest Air/Water Rules Met by New Kraft Mill at Halsey, Oregon,
W72-04993 5D

Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

The Qualitative Determination of the Odor Quality of Chicken Manure,
W72-05068 5B

The Quantitative Determination of the Odor Strength of Chicken Manure,
W72-05069 5A

Analyses of Gases Encountered in a Commercial Poultry House,
W72-05070 5A

Gases and Odors from Undiluted and Diluted Chicken Manure,
W72-05071 5B

Particulate Matter,
W72-05072 5A

Soil Filtration to Remove Odors,
W72-05073 5D

Odor Controls by Chemical Treatment,
W72-05074 5D

AIR TEMPERATURE
Equilibrium Temperatures of Water Surfaces as Related to Air Temperature and Solar Radiation,
W72-05026 2B

Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

ALBEDO
Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

ALDRIN
Dieldrin Levels in Fish From Iowa Streams,
W72-04739 5A

ALGAE
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

Algal-Bacterial Symbiosis for Removal and Conservation of Wastewater Nutrients,
W72-04983 5D

ALGICIDES
Biological and Bacteriological Evaluation of Pilot Plant Artificial Recharge Experiments,
W72-05143 4B

ALLUVIUM
Qanat Systems in Iran,
W72-04849 4B

ALTERNATIVES
Planning for People, Not Buildings,
W72-05133 6B

ALUM
Process Evaluation--Phosphorus Removal,
W72-04979 5D

AMMONIA
Discussion of 'Toxic Effects of Ammonia Nitrogen in High Rate Digestion',
W72-05016 5D

The Formation of Nitrate from Ammonium Nitrogen in Soils: IV. Use of the Delay and Maximum Rate Phases for Making Quantitative Predictions,
W72-05120 5B

AMMONIA-NITROGEN
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

AMMONIUM COMPOUNDS
A Comparison of Nitrogen Losses From Urea and Ammonium Nitrate in Surface Runoff Water,
W72-05142 5B

AMOEBIC CYSTS
Amoebic Cysticidal Properties of Halogens in Water,
W72-04746 5F

AMOUNT AND TIMING
Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

ANAEROBIC BACTERIA
Isolation and Counting of Athiorhodaceae with Membrane Filters,
W72-04743 5A

Energy Production in Anaerobic Organisms,
W72-05018 5D

ANAEROBIC CONDITIONS
Energy Production in Anaerobic Organisms,
W72-05018 5D

ANAEROBIC DIGESTION
Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

Influence of Temperature on Anaerobic Digestion,
W72-05010 5D

Discussion of 'Toxic Effects of Ammonia Nitrogen in High Rate Digestion',
W72-05016 5D

ANALOG MODELS
Progress Report on the Analog Model Study of the Magothy Aquifer in the Annapolis, Maryland Area.
W72-04840 4B

ANALYTICAL METHOD
The Vibrations of Transmission Line Conductor Bundles,
W72-04863 8C

ANALYTICAL TECHNIQUES
The Total Organic Carbon Analyzer and Its Application to Water Research,
W72-05001 5A

ESCA--The New Spectroscopy,
W72-05051 2K

ANEMOMETERS
The Chesapeake Bay Institute Wave Follower--Part II,
W72-04818 7B

ANIMAL HUSBANDRY
Bibliography of Products Derived from Aquatic Organisms.
W72-05086 5D

ANIMAL PATHOLOGY
Histological and Hematological Responses of an Estuarine Teleost to Cadmium,
W72-04709 5C

ANNAPOLIS (MD)
Progress Report on the Analog Model Study of the Magothy Aquifer in the Annapolis, Maryland Area.
W72-04840 4B

APPLE PROCESSING WASTES
Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

APPROACH
The Social Context of Urban Planning,
W72-04758 6B

AQUACULTURE
A Survey of Alternate Methods for Cooling Condenser Discharge Water, Total Community Considerations in the Utilization of Rejected Heat,
W72-04830 5D

Bibliography of Aquaculture.
W72-05087 5C

AQUATIC ALGAE
Formation of Phytoplankton in the Bratsk Reservoir (Formirovaniye fitoplanktona Bratskogo vodokhranilishcha),
W72-04855 5C

AQUATIC ANIMALS
A Quantitative Sampler for Aquatic Phytomacrofauna,
W72-04710 5A

Natural Conditions and Aquatic Life of the Bratsk Reservoir (Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha).
W72-04853 2H

Formation of Zooplankton in the Bratsk Reservoir During the First Two Years of Impoundment, 1962-63 (Formirovaniye zooplanktona v pervyye dva goda zapolneniya Bratskogo vodokhranilishcha (1962-1963 gg.)),
W72-04857 2H

Effects of Siltation and Coarser Sediments on Distribution and Abundance of Stream-Inhabiting Insects,
W72-05024 5C

AQUATIC BACTERIA
Natural Conditions and Aquatic Life of the Bratsk Reservoir (Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha).
W72-04853 2H

Aquatic Bacteria in the Bratsk Reservoir in 1965 (Bakterioplankton Bratskogo vodokhranilishcha v 1965 g.),
W72-04856 2H

Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

AQUATIC ENVIRONMENT
The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

AQUATIC LIFE
Natural Conditions and Aquatic Life of the Bratsk Reservoir (Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha).
W72-04853 2H

AQUATIC MICROBIOLOGY
Aquatic Bacteria in the Bratsk Reservoir in 1965 (Bakterioplankton Bratskogo vodokhranilishcha v 1965 g.),
W72-04856 2H

Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

AQUATIC PLANTS
The Distribution and Net Productivity of Sublittoral Populations of Attached Macrophytic Algae in an Estuary on the Atlantic Coast of Spain,
W72-04766 5C

Natural Conditions and Aquatic Life of the Bratsk Reservoir (Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha).
W72-04853 2H

Formation of Phytoplankton in the Bratsk Reservoir (Formirovaniye fitoplanktona Bratskogo vodokhranilishcha),
W72-04855 5C

Bibliography of Products Derived from Aquatic Organisms.
W72-05086 5D

AQUATIC POPULATIONS
Population Dynamics of Selected Zooplankton in Three Oligotrophic Oregon Lakes,
W72-04763 5C

AQUATIC WEEDS
Nutrient Removal by Waterhyacinth,
W72-04776 5C

AQUEOUS SOLUTIONS
Solubility of Barium and Strontium Sulfates in Strong Electrolyte Solutions,
W72-04793 5G

Specific Conductance Model for Natural Waters and Soil Solutions of Limited Salinity Levels,
W72-05053 2G

AQUICULTURE
Bibliography of Aquaculture.
W72-05087 5C

AQUIFER CHARACTERISTICS
Resistivity Soundings in the Condroz (Belgium) With Schlumberger and Dipole Arrays; Application to Limestone Aquifer Evaluation,
W72-04850 2F

AQUIFERS
The Use, Abuse and Recovery of a Glacial Aquifer,
W72-04802 5B

Progress Report on the Analog Model Study of the Magothy Aquifer in the Annapolis, Maryland Area.
W72-04840 4B

Groundwater Law, Management and Administration,
W72-05101 6E

AREA REDEVELOPMENT
Population Growth in Communities in Relation to Water Resources Policy.
W72-04785 6B

ARID CLIMATES
Alternative Water Policies for an Arid Region,
W72-04892 6B

ARKANSAS
Hydrologic Data for Horseshoe Lake, Arkansas, and Vicinity,
W72-04822 7C

ARTESIAN BASINS
Hydrogeology and Hydrodynamics of Groundwater (Gidrogeologiya i gidrodinamika podzemnykh vod),
W72-04832 2F

ARTIFICIAL PRECIPITATION
Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

ARTIFICIAL RECHARGE
Artificial Recharge of Aquifers (Alimentation Artificielle des Nappes),
W72-05044 4B

Biological and Bacteriological Evaluation of Pilot Plant Artificial Recharge Experiments,
W72-05143 4B

ASPHALT
Experimental Cationic Asphalt Emulsion Grouting,
W72-04869 8G

ATHIORHODACEAE
Isolation and Counting of Athiorhodaceae with Membrane Filters,
W72-04743 5A

AUTOMATION
Cartridge Magnetic Tape Incremental Recorder for Hydro-Meteorological Data Acquisition,
W72-04848 7A

AXISYMMETRIC INFILTRATION
Finite Difference Solutions of Axisymmetric Infiltration Through Partially Saturated Porous Media,
W72-04805 2G

BACTERIA
Survival of Coliform Bacteria in Wastewater Treatment Lagoons,
W72-04976 5D

Algal-Bacterial Symbiosis for Removal and Conservation of Wastewater Nutrients,
W72-04983 5D

BACTERIOLOGY
Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

BALTIMORE
Operation of Conventional Activated Sludge for Maximum Phosphorus Removal,
W72-04978 5D

BAYS
Volumetric, Areal, and Tidal Statistics of The Chesapeake Bay Estuary and Its Tributaries,
W72-04838 2L

BEACH EROSION
Wind Stress Criteria in Eolian Sand Transport,
W72-05037 2J

BEACHES
Groundwater Flow in a Sandy Tidal Beach: Two-Dimensional Finite Element Analysis,
W72-05033 2F

BENTHIC FAUNA
Comparison of Some Species Importance Values and Ordination Techniques Used to Analyse Benthic Invertebrate Communities,
W72-04716 5A

BENTHOS
Comparison of Some Species Importance Values and Ordination Techniques Used to Analyse Benthic Invertebrate Communities,
W72-04716 5A

BERING SEA
Effect of Upwelling, Mixing, and High Primary Productivity on CO2 Concentrations in Surface Waters of the Bering Sea,
W72-05038 2K

BIOASSAY
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

BIOCHEMICAL OXYGEN DEMAND
Analytical Parameters of Petrochemical and Refinery Wastewaters,
W72-05014 5D

BIOCHEMISTRY
Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

BIODEGRADATION
Biological Treatment of Chlorophenolic Wastes.
W72-04825 5D

The Economic Feasibility of Treating Textile Wastes in Municipal Systems,
W72-04989 5D

BIOINDICATORS
Coliform Aerosols Emitted by Sewage Treatment Plants,
W72-04711 5D

Distribution of Blue-Green Algal Viruses in Various Types of Natural Waters,
W72-04736 5B

Population Dynamics of Selected Zooplankton in Three Oligotrophic Oregon Lakes,
W72-04763 5C

BIOLOGICAL LUXURY UPTAKE
Phosphorus Removal by Luxury Uptake,
W72-05011 5D

BIOLOGICAL SAMPLING
Guidelines: Biological Surveys at Proposed Heat Discharge Sites,
W72-04828 5G

BIOLOGICAL TREATMENT
Biological Treatment of Chlorophenolic Wastes.
W72-04825 5D

BIORTHYMS
Diurnal Rhythms in Netplankton and Nannoplankton Assimilation Ratios,
W72-04770 5C

BIRDS
Residues of Polychlorobiphenyls in Biological Samples,
W72-04754 5A

BLOOD
Histological and Hematological Responses of an Estuarine Teleost to Cadmium,
W72-04709 5C

BLUE-GREEN ALGAL VIRUSES
Distribution of Blue-Green Algal Viruses in Various Types of Natural Waters,
W72-04736 5B

BOOMS
Oil Spill Containment Systems.
W72-04826 5G

BOTTOM SEDIMENTS
A Simplified Tube Bottom Sampler,
W72-04715 7B

BOTULISM
Detection of Clostridium Botulinum Type E in Smoked Fish,
W72-04745 5A

BOUNDARY PROCESSES
Advanced Organics Removal by Pulsed Adsorption Beds,
W72-05005 5D

BRATSK RESERVOIR
Natural Conditions and Aquatic Life of the Bratsk Reservoir (Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha).
W72-04853 2H

Seasonal Meteorological Conditions in the Region of the Bratsk Reservoir (Sezonnyye meteorologicheskiye usloviya v rayone Bratskogo vodokhranilishcha),
W72-04854 2H

BRATSK RESERVOIR

Formation of Phytoplankton in the Bratsk Reservoir (Formirovaniye fitoplanktona Bratskogo vodokhranilishcha),
W72-04855 5C

Aquatic Bacteria in the Bratsk Reservoir in 1965 (Bakterioplankton Bratskogo vodokhranilishcha v 1965 g.),
W72-04856 2H

Formation of Zooplankton in the Bratsk Reservoir During the First Two Years of Impoundment, 1962-63 (Formirovaniye zooplanktona v pervyye dva goda zapolneniya Bratskogo vodokhranilishcha (1962-1963 gg.)),
W72-04857 2H

Fish Population and Distribution in the Oka River Section of the Bratsk Reservoir (Razmeshcheniye i chislennost' ryb v Okinskoy chasti Bratskogo vodokhranilishcha),
W72-04858 2H

Long-Term Water-Quality Characteristics of the Bratsk Reservoir and Forecast of Organic Matter Accumulation (Mnogoletnyaya kharakteristika formirovaniya kachestva vody i prognoz nakopleniya organicheskogo veshchestva v Bratskom vodok hranilishche),
W72-04859 5C

Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

BRITISH COLUMBIA

A Geochemical Drainage Survey and Its Implications for Metallogenesis, Central Coast Mountains, British Columbia,
W72-04798 2K

BROMACIL

Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

BUNDLED CONDUCTORS

The Vibrations of Transmission Line Conductor Bundles,
W72-04863 8C

BUS (ELECTRICAL)

The Response of Substation Bus Systems to Short Circuit Conditions: Part I, II, III,
W72-04862 8C

BY-PRODUCTS

Dead Bird Disposal by Rendering,
W72-05055 5E

CADDISFLIES

Life Histories and Drifting of Three Species of Limnephilidae (Trichoptera),
W72-04714 5A

CADMIUM

Histological and Hematological Responses of an Estuarine Teleost to Cadmium,
W72-04709 5C

Metals Focus Shifts to Cadmium.
W72-04727 5B

The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

CALIBRATIONS

Potassium Fluoride - A Reference Standard for Fluoride Ion Activity,
W72-04741 5A

CALIFORNIA

Morphogenesis of Granitic Boulder Slopes in the Mojave Desert, California,
W72-04813 2J

Estimated Subsidence in the Raymond Basin, Los Angeles County, California, for a Postulated Water-Level Lowering, 1970-2020,
W72-04823 4B

Water Chemistry of the Santa Clara Valley, California,
W72-04835 2K

Descriptions and Chemical Analyses for Selected Wells in the Dos Palos-Kettleman City area, San Joaquin Valley, California,
W72-04843 2K

The Mill River and Its Floodplain in Northampton and Williamsburg, Mass.: A Study of the Vascular Plant Flora, Vegetation, and the Presence of the Bacterial Family Pseudomonadaceae in Relation to Patterns of Land Us e,
W72-05092 5C

CANOPY

New Landmark in the White Mountains,
W72-05080 2A

CARBON

The Growth of Pores in Graphitized Carbon Reacted with Carbon Dioxide,
W72-04704 5D

ABCs of Cultural Eutrophication and Its Control. Part I--Cultural Changes,
W72-04769 5C

CARBON DIOXIDE

Nutrients and Carbon Dioxide in the Columbia River,
W72-04974 5B

Effect of Upwelling, Mixing, and High Primary Productivity on CO2 Concentrations in Surface Waters of the Bering Sea,
W72-05038 2K

CATION ADSORPTION

Cation Adsorption in One-Dimensional Flow Through Soils: A Numerical Solution,
W72-05031 2G

CATION EXCHANGE

Cation Exchange Selectivity of Some Clay-Sized Minerals and Soil Materials,
W72-05127 2K

CATIONIC ASPHALT

Experimental Cationic Asphalt Emulsion Grouting,
W72-04869 8G

CATTLE

Dried Poultry Waste as a Protein Source for Feedlot Cattle,
W72-05064 5E

CEMENT GROUTS

Experimental Cationic Asphalt Emulsion Grouting,
W72-04869 8G

CHELATES

Determination of Nitrilotriacetic Acid by High-Speed Ion Exchange Chromatography,
W72-04901 5A

CHELATION

Removal of Trace Metals From Marine Culture Media,
W72-04708 5A

CHEMICAL ANALYSIS

Solubility of Barium and Strontium Sulfates in Strong Electrolyte Solutions,
W72-04793 5G

Records of Wells, Drillers' Logs, and Chemical Analysis of Ground Water in Galveston County, Texas 1952-1970,
W72-04795 4B

Descriptions and Chemical Analyses for Selected Wells in the Dos Palos-Kettleman City area, San Joaquin Valley, California,
W72-04843 2K

ESCA--The New Spectroscopy,
W72-05051 2K

CHEMICAL OXYGEN DEMAND

Analytical Parameters of Petrochemical and Refinery Wastewaters,
W72-05014 5D

CHEMICAL REACTIONS

Recurrence Relations for First Order Sequential Reactions in Natural Waters,
W72-05027 5B

CHEMICAL TREATMENT

Odor Controls by Chemical Treatment,
W72-05074 5D

CHEMOSTATIC CONTINUOUS CULTURES

Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

CHESAPEAKE BAY

Volumetric, Areal, and Tidal Statistics of The Chesapeake Bay Estuary and Its Tributaries,
W72-04838 2L

CHESAPEAKE BAY TRIBUTARIES

Volumetric, Areal, and Tidal Statistics of The Chesapeake Bay Estuary and Its Tributaries,
W72-04838 2L

CHICKENS

Dead Bird Disposal by Rendering,
W72-05055 5E

CHLORELLA

Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

CHLORINATED HYDROCARBON PESTICIDES

Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides,
W72-04738 5A

Chlorinated Hydrocarbon Pesticides in Iowa Rivers,
W72-04753 5B

CHLOROPHENOLS

Biological Treatment of Chlorophenolic Wastes.
W72-04825 5D

CHLOROPHYLL A

Primary Production and Chlorophyll a Content of Nanoplankton in a Eutrophic Lake,
W72-04717 5C

CHROMATOGRAPHY
Determination of Nitrilotriacetic Acid by High-Speed Ion Exchange Chromatography,
W72-04901 5A

CHROMIUM
Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

CITIES
Rainfall and Run-off from an Industrial Area in Nairobi, Kenya,
W72-04837 4C

Runoff from Impervious Surfaces,
W72-04844 4C

Effects of Urbanization on Storm Water Runoff Quality: A Limited Experiment, Naismith Ditch, Lawrence, Kansas,
W72-05035 4C

CITY PLANNING
The Social Context of Urban Planning,
W72-04758 6B

Community Decision Behavior: The Culture of Planning,
W72-04760 6A

Population Growth in Communities in Relation to Water Resources Policy.
W72-04785 6B

Forecasting Planning,
W72-05082 6B

Planning for People, Not Buildings,
W72-05133 6B

CLARIFICATION
Recent Experiences in Plant-Scale Application of the Settling Tube Concept,
W72-04991 5D

CLAYS
Complexes of Halloysite with Organic Compounds,
W72-05043 2K

CLEAR-CUTTING
Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

New Landmark in the White Mountains,
W72-05080 2A

CLEAR WATER RESERVOIRS
Eutrophication of Small Reservoirs in the Great Plains,
W72-04761 5C

CLOSTRIDIUM
Effects of Sodium Chloride on Outgrowth and Toxin Production of Clostridium botulinum Type E in cod Homogenates,
W72-04737 5C

Detection of Clostridium Botulinum Type E in Smoked Fish,
W72-04745 5A

CLOUD SEEDING
Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

Hydrometeorology in Precipitation Management,
W72-04866 6B

COAGULATION
Microstraining Paper Mill Wastewater,
W72-04996 5D

COAL MINES
Cost of Reclamation and Mine Drainage Abatement-Elkins Demonstration Project,
W72-05146 5G

COASTS
Coastal Sedimentation of Southeastern Lake Michigan, Field Trip Guidebook,
W72-04807 2J

COD
Effects of Sodium Chloride on Outgrowth and Toxin Production of Clostridium botulinum Type E in cod Homogenates,
W72-04737 5C

COLIFORMS
Survival of Coliform Bacteria in Wastewater Treatment Lagoons,
W72-04976 5D

Bacterial Counts of a Section of the Red River -- Summer, 1970,
W72-05056 5A

COLORADO
Water Quality Office.
W72-04791 5C

Methods of Geologic Evaluation of Pollution Potential at Mountain Homesites,
W72-04803 5B

Hydrologic Data for the San Luis Valley, Colorado,
W72-05025 7C

COLORADO RIVER
Space-Time Sampling of Ecological Systems,
W72-04779 6A

COLORADO RIVER BASIN PROJECT ACT
A National Policy for Western Water Development,
W72-04895 6B

COLORADO RIVER PILOT PROJECT
Hydrometeorology in Precipitation Management,
W72-04866 6B

COLORIMETRY
Methods for Chemical Analysis of Water and Wastes, 1971.
W72-04735 5A

COLUMBIA RIVER
Nutrients and Carbon Dioxide in the Columbia River,
W72-04974 5B

COMBINED SEWER OVERFLOW
Microstraining of Combined Sewer Overflows,
W72-04971 5D

COMBINED SEWER OVERFLOWS
Demonstration of Rotary Screening for Combined Sewer Overflows.
W72-04827 5D

COMBINED TREATMENT
Biological Treatment of Chlorophenolic Wastes.
W72-04825 5D

COMBUSTION
The Total Organic Carbon Analyzer and Its Application to Water Research,
W72-05001 5A

COMMUNICATION
Environmental Policy: Public Participation and the Open Information System,
W72-05132 6E

COMMUNITY DECISION BEHAVIOR
Community Decision Behavior: The Culture of Planning,
W72-04760 6A

COMMUNITY DEVELOPMENT
Population Growth in Communities in Relation to Water Resources Policy.
W72-04785 6B

COMPUTER MODEL
Numerical Modeling of Unsaturated Groundwater Flow Including Effects of Evapotranspiration,
W72-05089 2G

COMPUTER PROGRAMS
Hymo, A Problem-Oriented Computer Language for Building Hydrologic Models,
W72-05028 7C

A Computerized Educational Program for the Application of the Management Sciences to Water Resource Management,
W72-05088 7C

CONCENTRATION
Hydrogen Isotope Ratios in a Recycling System,
W72-04967 5D

CONDUCTIVITY
Specific Conductance Model for Natural Waters and Soil Solutions of Limited Salinity Levels,
W72-05053 2G

CONGRESS
Environmental Policy and the Congress,
W72-05118 6E

CONJUNCTIVE MANAGEMENT
Administrative Allocation of Water,
W72-04786 6E

CONTAINMENT SYSTEMS
Industrial Spill Control and Pollution Incident Prevention,
W72-05017 5G

COOLING
Research on Dry-Type Cooling Towers for Thermal Electric Generation: Part I,
W72-04829 5D

COOLING PONDS
An Engineering-Economic Study of Cooling Pond Performance.
W72-04831 5D

COOLING WATER
An Engineering-Economic Study of Cooling Pond Performance.
W72-04831 5D

COORDINATION
A Look Ahead in Planning Coordination and Policy Making,
W72-04884 6B

COPEPODS
Advances in the Continuous Culture of Planktonic Copepods,
W72-04900 5A

COPPER
The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

CORE DRILLING
A Simplified Tube Bottom Sampler,
W72-04715 7B

CORRELATION ANALYSIS
Analytical Parameters of Petrochemical and Refinery Wastewaters,
W72-05014 5D

COST ANALYSIS
The Economic Feasibility of Treating Textile Wastes in Municipal Systems,
W72-04989 5D

COST-BENEFIT ANALYSIS
Strategies for Control of Man-Made Eutrophication,
W72-04734 5D

The Third Western Interstate Water Conference of Colorado State University,
W72-04886 6B

COSTS
Water Resources Planning,
W72-04885 6B

Information Requirement for Socio-Ecological Models,
W72-05119 6A

CRACKING
Soil-Desiccation Features in South Dakota Depressions,
W72-04812 2G

CREEP
The Measurement of Small Soil Displacements on a Dutch Hillslope,
W72-05040 2G

CRITICAL DEPTH
Critical-Depth Flumes for Determining Flow in Canals and Natural Channels,
W72-04871 8B

CRUSTACEANS
Bibliography of Aquaculture.
W72-05087 5C

CULTURES
Isolation and Counting of Athiorhodaceae with Membrane Filters,
W72-04743 5A

Cultural Estimation of Yeasts on Seaweeds,
W72-04748 5A

Advances in the Continuous Culture of Planktonic Copepods,
W72-04900 5A

CUMULATIVE FLOW
Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

CURRENT METERS
Results of a Field Study Using the 3-Axis Doppler Shift Current Meter,
W72-04817 2L

CYANOPHYTA
Distribution of Blue-Green Algal Viruses in Various Types of Natural Waters,
W72-04736 5B

CYCLES
An Artificial Alteration of the Seasonal Cycle of the Plankton Diatom Melosira Italica Subsp Subarctica in an English Lake,
W72-04765 5C

CYSTICIDES
Amoebic Cysticidal Properties of Halogens in Water,
W72-04746 5F

DAMS
Floods on Yahara River, Lake Kegonsa Dam to County Line, Dane County, Wisconsin,
W72-04815 4A

DATA COLLECTION
Guidelines: Biological Surveys at Proposed Heat Discharge Sites,
W72-04828 5G

Records of Wells, Springs, and Test Borings, Chemical Analyses of Water, Sediment Analyses, Standard Streamflow Data Summaries, and Selected Drillers' Logs From The Little Kanawha River Basin in West Virginia,
W72-04841 7C

DATA COLLECTIONS
Development of a Procedure for Determining Spacial and Time Variations of Precipitation in Venezuela,
W72-04804 2B

Thermal Mapping of Selected Sites in the Lake Kinneret Region,
W72-04811 7B

The Chesapeake Bay Institute Wave Follower--Part II,
W72-04818 7B

Hydrologic Data for Horseshoe Lake, Arkansas, and Vicinity,
W72-04822 7C

Cartridge Magnetic Tape Incremental Recorder for Hydro-Meteorological Data Acquisition,
W72-04848 7A

Some Results of Hydromteorological Research Work Carried Out in The Experimental Basins of the Meteorological Service of German Democratic Republic,
W72-05046 2A

Water Resources Data for Wisconsin, 1969: Part 1. Surface Water Records, and Part 2. Water Quality Records.
W72-05094 7C

Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

Streamflow, Groundwater and Ground Response Data--Volume II, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05096 7C

DDD
DDT in Forest Streams,
W72-04719 5B

DDE
DDT in Forest Streams,
W72-04719 5B

Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

DDT
DDT in Forest Streams,
W72-04719 5B

Dieldrin Levels in Fish From Iowa Streams,
W72-04739 5A

Organochlorine Insecticide Residues in Everglades National Park and Loxahatchee National Wildlife Refuge, Florida,
W72-04799 5B

Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

DECISION MAKING
The Social Context of Urban Planning,
W72-04758 6B

Community Decision Behavior: The Culture of Planning,
W72-04760 6A

Public Participation and Environmental Quality,
W72-04839 6A

The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

Environmental Policy and Politics: Value and Power Context,
W72-04985 6B

A New Dimension of State Planning -- Policy Development and Issue Analysis,
W72-05052 6E

Forecasting Planning,
W72-05082 6B

Environmental Policy: Public Participation and the Open Information System,
W72-05132 6E

DEFORMATION
Structural Measurements With Holographic Interferometry,
W72-04865 8A

DEHYDRATION
The Metabolizeable Energy Value of Dried Poultry Waste,
W72-05065 5E

The Effects of Continually Recycling Dehydrated Poultry Wastes (DPW) on the Performance of SCWL Laying Hens -- A Preliminary Report,
W72-05066 5E

DENITRIFICATION
Nitrification and Denitrification in Activated Sludge Systems,
W72-05019 5D

Denitrification as a Nitrogen Sink in Lake Mendota, Wisconsin,
W72-05130 5B

DEPTH-AREA-DURATION ANALYSIS
The Use of Non-Dimensional One-Parameter Functions For The Determination of Regional Rainfall Depth-Duration-Frequency Relations,
W72-05047 2A

DESICCATION CRACKS
Soil-Desiccation Features in South Dakota Depressions,
W72-04812 2G

DESIGN
An Engineering-Economic Study of Cooling Pond Performance.
W72-04831 5D

DESIGN CRITERIA
Redesigning Existing Facilities to Increase Hydraulic and Organic Loading,
W72-05004 5D

DETERGENTS
Probable Impact of NTA on Ground Water,
W72-04800 5B

Determination of Nitrilotriacetic Acid by High-Speed Ion Exchange Chromatography,
W72-04901 5A

DEUTERIUM
Hydrogen Isotope Ratios in a Recycling System,
W72-04967 5D

DEWATERING
Polymers in the Filtration of Raw Sludge,
W72-04968 5D

DIATOMS
An Artificial Alteration of the Seasonal Cycle of the Plankton Diatom Melosira Italica Subsp Subarctica in an English Lake,
W72-04765 5C

DIELDRIN
Dieldrin Levels in Fish From Iowa Streams,
W72-04739 5A

Chlorinated Hydrocarbon Pesticides in Iowa Rivers,
W72-04753 5B

DIGESTER FAILURE
Toxic Effects of Ammonia Nitrogen in High-Rate Digestion,
W72-05015 5D

DIGESTION
Operational Stability of the Extended Aeration Process,
W72-04784 5D

Toxic Effects of Ammonia Nitrogen in High-Rate Digestion,
W72-05015 5D

DISCHARGE (WATER)
Flow Over Rounded Spillways,
W72-04809 8B

Groundwater Discharge: A Common Generator of Diverse Geologic and Morphologic Phenomena,
W72-04851 2F

DISPERSION
Statistical Geometry of Porous Media,
W72-04783 2G

DISTRIBUTION
The Distribution and Net Productivity of Sublittoral Populations of Attached Macrophytic Algae in an Estuary on the Atlantic Coast of Spain,
W72-04766 5C

DISTRIBUTION PATTERNS
Vertical Distribution of Some Ciliated Protozoa in Two Freshwater Sediments,
W72-04718 5C

Distribution of Blue-Green Algal Viruses in Various Types of Natural Waters,
W72-04736 5B

A Geochemical Drainage Survey and Its Implications for Metallogenesis, Central Coast Mountains, British Columbia,
W72-04798 2K

The Use of Non-Dimensional One-Parameter Functions For The Determination of Regional Rainfall Depth-Duration-Frequency Relations,
W72-05047 2A

A Truncated Square-Root-Normal Distribution Applied to Monthly Precipitation Totals for Ghent (Belgium),
W72-05048 2B

DISTRIBUTIONAL PATTERNS
Population Growth in Communities in Relation to Water Resources Policy.
W72-04785 6B

DISTRIBUTIVE JUSTICE
Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

DIURNAL
Diurnal Rhythms in Netplankton and Nannoplankton Assimilation Ratios,
W72-04770 5C

DIVERSION STRUCTURES
Catalog of Recharge Basins on Long Island, N.Y., In 1969,
W72-04833 4A

DOMINANCE
Ecology and Technology in Twentieth-Century Landscapes,
W72-04980 6B

DOMINANT ORGANISMS
Ecology and Technology in Twentieth-Century Landscapes,
W72-04980 6B

DOPPLER CURRENT METER
Results of a Field Study Using the 3-Axis Doppler Shift Current Meter,
W72-04817 2L

DRAINAGE
Catalog of Recharge Basins on Long Island, N.Y., In 1969,
W72-04833 4A

Water Balance and Regionalization of Drainage in the Turkmen SSR (Vodnyy balans i rayonirovaniye drenazha v Turkmenskoy SSR),
W72-04861 4A

The Amelioration of Gley and Pseudogley Soils,
W72-04899 2G

Effect of Water Table Depth and Flooding on Yield of Millet,
W72-05124 2G

DRAINAGE PATTERNS (GEOLOGIC)
Application of Stream Order Numbers to the Merrimack River Basin,
W72-05036 4A

DRAINAGE SYSTEMS
Water Balance and Regionalization of Drainage in the Turkmen SSR (Vodnyy balans i rayonirovaniye drenazha v Turkmenskoy SSR),
W72-04861 4A

DREDGING
Inland Lake Dredging Evaluation.
W72-04778 8C

DREDGING EQUIPMENT
Inland Lake Dredging Evaluation.
W72-04778 8C

DRIED POULTRY WASTE
Poultry Pollution: Research Results,
W72-05058 5E

The Metabolizeable Energy Value of Dried Poultry Waste,
W72-05065 5E

The Effects of Continually Recycling Dehydrated Poultry Wastes (DPW) on the Performance of SCWL Laying Hens -- A Preliminary Report,
W72-05066 5E

DRY COOLING TOWERS
Research on Dry-Type Cooling Towers for Thermal Electric Generation: Part I,
W72-04829 5D

DRYING
Block Drying of Chicken Manure,
W72-05054 5D

The Relationship of Drying Temperature to Total Crude Protein in Dried Poultry Waste,
W72-05062 5E

Drying of Poultry Manure in a Cage-Layer House,
W72-05063 5E

E. COLI
Coliform Aerosols Emitted by Sewage Treatment Plants,
W72-04711 5D

EARLY IMPOUNDMENT
Aquatic Bacteria in the Bratsk Reservoir in 1965 (Bakterioplankton Bratskogo vodokhranilishcha v 1965 g.),
W72-04856 2H

Formation of Zooplankton in the Bratsk Reservoir During the First Two Years of Impoundment, 1962-63 (Formirovaniye zooplanktona v pervyye dva goda zapolneniya Bratskogo vodokhranilishcha (1962-1963 gg.)),
W72-04857 2H

ECOLOGICAL DISTRIBUTION
A Quantitative Plankton Sampler,
W72-04713 7B

ECOLOGICAL INFORMATION
The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

ECOLOGICAL RELATIONSHIPS
The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

ECOLOGY
A Quantitative Plankton Sampler,
W72-04713 7B

The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

Ecology and Technology in Twentieth-Century Landscapes,
W72-04980 6B

Ecology and Man, The Dilemma of Our Technological Culture,
W72-05084 6B

Information Requirement for Socio-Ecological Models,
W72-05119 6A

ECONOMIC EVALUATION
Research on Dry-Type Cooling Towers for Thermal Electric Generation: Part I,
W72-04829 5D

An Engineering-Economic Study of Cooling Pond Performance.
W72-04831 5D

ECONOMIC GROWTH
Environmental Policy in a Hypertrophic Society,
W72-04938 6B

ECONOMIC IMPACT
Water Resource Investments and National Goals,
W72-04891 6B

ECONOMIC JUSTICE
Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

ECONOMIC MATERIALISM
The Environmental Movement: Ambiguities and Meanings,
W72-05021 6B

ECONOMIC MODEL
The Reuse of Water in Manufacturing: An Explanatory Economic Model with Data Analysis,
W72-05093 3E

ECONOMIC PLANNERS
Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

ECONOMICAL RADIOMETER
Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

ECONOMICAL RADIOMETERS
Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

ECONOMICS
Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

Algebraic Technological Function from a Simulation Model,
W72-05034 6A

Ecology and Man, The Dilemma of Our Technological Culture,
W72-05084 6B

ECONOMY
Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

ECOSYSTEM
Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

ECUADORIAN BEACHES
Wind Stress Criteria in Eolian Sand Transport,
W72-05037 2J

EDTA
Determination of Nitrilotriacetic Acid by High-Speed Ion Exchange Chromatography,
W72-04901 5A

EDUCATION
A Computerized Educational Program for the Application of the Management Sciences to Water Resource Management,
W72-05088 7C

EFFLUENTS
Where Will All the People Go. How Much Will They Dump When They Get There -- Population Distribution, Environmental Damage, and the Quality of Life,
W72-05123 6B

EICHHORNIA CRASSIPES
Nutrient Removal by Waterhyacinth,
W72-04776 5C

ELECTRICAL CONDUCTANCE
Specific Conductance Model for Natural Waters and Soil Solutions of Limited Salinity Levels,
W72-05053 2G

ELECTRICAL DESIGN
The Response of Substation Bus Systems to Short Circuit Conditions: Part I, II, III,
W72-04862 8C

ELECTRICAL STUDIES
Resistivity Soundings in the Condroz (Belgium) With Schlumberger and Dipole Arrays; Application to Limestone Aquifer Evaluation,
W72-04850 2F

ELECTROKINETICS
The Effects of Electrokinetics Upon Incrustation in Water Wells,
W72-04870 8A

ELECTRON MICROSCOPY
Election Micrographs of Lake Kinneret Sediments,
W72-04810 2J

ELECTRON SPECTROSCOPY
ESCA--The New Spectroscopy,
W72-05051 2K

ELKINS (W VA)
Cost of Reclamation and Mine Drainage Abatement-Elkins Demonstration Project,
W72-05146 5G

ENERGY BALANCE
Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

ENERGY BUDGET
An Engineering-Economic Study of Cooling Pond Performance.
W72-04831 5D

ENERGY EQUATIONS
Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

ENERGY PRODUCTION
Energy Production in Anaerobic Organisms,
W72-05018 5D

ENERGY TRANSFER
Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

ENVIRONMENT
The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

Environmental Policy in a Hypertrophic Society,
W72-04938 6B

Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

Environmental Policy and Politics: Value and Power Context,
W72-04985 6B

The Environmental Movement: Ambiguities and Meanings,
W72-05021 6B

Cooperation of Government, Science, and Industry in Research and Development - A Systems View,
W72-05075 6B

Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

Environmental Policy and the Congress,
W72-05118 6E

Where Will All the People Go. How Much Will They Dump When They Get There -- Population Distribution, Environmental Damage, and the Quality of Life,
W72-05123 6B

Environmental Policy: Public Participation and the Open Information System,
W72-05132 6E

ENVIRONMENTAL EFFECTS
Water Resources Planning,
W72-04885 6B

The Role of Recreation and Environmental Quality in Water Management,
W72-04894 6B

Environmental Policy and Politics: Value and Power Context,
W72-04985 6B

The Environmental Movement: Ambiguities and Meanings,
W72-05021 6B

Ecology and Man, The Dilemma of Our Technological Culture,
W72-05084 6B

Information Requirement for Socio-Ecological Models,
W72-05119 6A

ENVIRONMENTAL ENGINEERING
A Survey of Alternate Methods for Cooling Condenser Discharge Water, Total Community Considerations in the Utilization of Rejected Heat,
W72-04830 5D

ENVIRONMENTAL MOVEMENT
The Environmental Movement: Ambiguities and Meanings,
W72-05021 6B

ENVIRONMENTAL POLICY
Environmental Policy in a Hypertrophic Society,
W72-04938 6B

Environmental Policy and Politics: Value and Power Context,
W72-04985 6B

Environmental Policy and the Congress,
W72-05118 6E

Environmental Policy: Public Participation and the Open Information System,
W72-05132 6E

ENVIRONMENTAL QUALITY
Public Participation and Environmental Quality,
W72-04839 6A

Environmental Policy in a Hypertrophic Society,
W72-04938 6B

Environmental Policy and the Congress,
W72-05118 6E

ENZYMES
Energy Production in Anaerobic Organisms,
W72-05018 5D

ESTIMATING
Space-Time Sampling of Ecological Systems,
W72-04779 6A

ESTUARIES
The Distribution and Net Productivity of Sublittoral Populations of Attached Macrophytic Algae in an Estuary on the Atlantic Coast of Spain,
W72-04766 5C

Results of a Field Study Using the 3-Axis Doppler Shift Current Meter,
W72-04817 2L

Volumetric, Areal, and Tidal Statistics of The Chesapeake Bay Estuary and Its Tributaries,
W72-04838 2L

ESTUARINE ENVIRONMENT
An Intersectoral Programming Model for the Management of the Waste Water Economy of the San Francisco Bay Region,
W72-04780 5B

EUTROPHICATION
Levels of Inorganic and Total Phosphorus in Lake Sediments as Related to Other Sediment Parameters,
W72-04732 5C

Strategies for Control of Man-Made Eutrophication,
W72-04734 5D

Eutrophication of Small Reservoirs in the Great Plains,
W72-04759 5C

Eutrophication of Small Reservoirs in the Great Plains,
W72-04761 5C

ABCs of Cultural Eutrophication and Its Control. Part I--Cultural Changes,
W72-04769 5C

Nutrient Removal by Waterhyacinth,
W72-04776 5C

EVALUATION
Hydrometeorology in Precipitation Management,
W72-04866 6B

Improving the Planning Process--Establishing Values,
W72-04888 6B

Biological and Bacteriological Evaluation of Pilot Plant Artificial Recharge Experiments,
W72-05143 4B

EVAPORATION
New Landmark in the White Mountains,
W72-05080 2A

Plant Growth-Evapotranspiration Relations for Several Crops in the Central Great Plains,
W72-05147 2D

EVAPOTRANSPIRATION
Numerical Modeling of Unsaturated Groundwater Flow Including Effects of Evapotranspiration,
W72-05089 2G

Plant Growth-Evapotranspiration Relations for Several Crops in the Central Great Plains,
W72-05147 2D

Concepts of Soil Moisture Availability and Their Effect on Soil Moisture Estimates from a Meteorological Budget,
W72-05149 2D

EVERGLADES (FLA)
Organochlorine Insecticide Residues in Everglades National Park and Loxahatchee National Wildlife Refuge, Florida,
W72-04799 5B

EVOLUTION
A New Look at National Water Policy,
W72-04882 6B

EXCESS WATER (SOILS)
The Amelioration of Gley and Pseudogley Soils,
W72-04899 2G

EXPANSIVE SOILS
Soil-Desiccation Features in South Dakota Depressions,
W72-04812 2G

EXPLORATION
A Geochemical Drainage Survey and Its Implications for Metallogenesis, Central Coast Mountains, British Columbia,
W72-04798 2K

EXTENDED AERATION
Design and Operation of an Extended Aeration Plant,
W72-04973 5D

EXTERNALITIES
Where Will All the People Go. How Much Will They Dump When They Get There -- Population Distribution, Environmental Damage, and the Quality of Life,
W72-05123 6B

FACILITIES REDESIGN
Redesigning Existing Facilities to Increase Hydraulic and Organic Loading,
W72-05004 5D

FACTUAL CONTENT
The Social Context of Urban Planning,
W72-04758 6B

FARM WASTE
Dead Bird Disposal by Rendering,
W72-05055 5E

Dried Poultry Waste as a Protein Source for Feedlot Cattle,
W72-05064 5E

FARM WASTES
Agricultural Pollution of the Great Lakes Basin.
W72-04762 5B

Some Observations on the Limnology of a Pond Receiving Animal Wastes,
W72-04773 5C

Block Drying of Chicken Manure,
W72-05054 5D

Handling Livestock Waste,
W72-05057 5D

Poultry Pollution: Research Results,
W72-05058 5E

Early Experiments at Michigan State University Involving the Use of Chicken Manure,
W72-05059 5E

Economics of Dried Poultry Waste (DPW) as a Feed Ingredient or a Fertilizer,
W72-05060 5E

Feeding Dehydrated Poultry Waste to Dairy Cows,
W72-05061 5E

The Relationship of Drying Temperature to Total Crude Protein in Dried Poultry Waste,
W72-05062 5E

Drying of Poultry Manure in a Cage-Layer House,
W72-05063 5E

FARM WASTES

The Metabolizeable Energy Value of Dried Poultry Waste,
W72-05065 5E

The Effects of Continually Recycling Dehydrated Poultry Wastes (DPW) on the Performance of SCWL Laying Hens -- A Preliminary Report,
W72-05066 5E

Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

The Qualitative Determination of the Odor Quality of Chicken Manure,
W72-05068 5B

The Quantitative Determination of the Odor Strength of Chicken Manure,
W72-05069 5A

Analyses of Gases Encountered in a Commercial Poultry House,
W72-05070 5A

Particulate Matter,
W72-05072 5A

Soil Filtration to Remove Odors,
W72-05073 5D

Odor Controls by Chemical Treatment,
W72-05074 5D

FEDERAL GOVERNMENT
Environmental Policy and the Congress,
W72-05118 6E

FEDERAL PROJECT POLICY
A National Policy for Western Water Development,
W72-04895 6B

FEEDLOTS
Some Observations on the Limnology of a Pond Receiving Animal Wastes,
W72-04773 5C

FERMENTATION
Influence of Temperature on Anaerobic Digestion,
W72-05010 5D

FERTILIZER
Phosphorus Fertilization of Hops,
W72-05148 5B

FILAMENTOUS MICROORGANISMS
Identification of Filamentous Microorganisms in Activated Sludge,
W72-04984 5B

FILTRATION
Demonstration of Rotary Screening for Combined Sewer Overflows.
W72-04827 5D

Polymers in the Filtration of Raw Sludge,
W72-04968 5D

FISH
Dieldrin Levels in Fish From Iowa Streams,
W72-04739 5A

Fish Population and Distribution in the Oka River Section of the Bratsk Reservoir (Razmeshcheniye i chislennost' ryb v Okinskoy chasti Bratskogo vodokhranilishcha),
W72-04858 2H

Bibliography of Products Derived from Aquatic Organisms.
W72-05086 5D

FISH ESTABLISHMENT
Fish Population and Distribution in the Oka River Section of the Bratsk Reservoir (Razmeshcheniye i chislennost' ryb v Okinskoy chasti Bratskogo vodokhranilishcha),
W72-04858 2H

FISH FARMING
Bibliography of Aquaculture.
W72-05087 5C

FISH POPULATIONS
Fish Population and Distribution in the Oka River Section of the Bratsk Reservoir (Razmeshcheniye i chislennost' ryb v Okinskoy chasti Bratskogo vodokhranilishcha),
W72-04858 2H

FISH PROTEIN
Bibliography of Products Derived from Aquatic Organisms.
W72-05086 5D

FLOATING BOOMS
Oil Spill Containment Systems.
W72-04826 5G

FLOOD DAMAGE
Floods of July 4-8, 1969 in North-Central Ohio,
W72-04852 2E

Agricultural Flood Damage Assessment: A Review and Investigation of a Simulation Method,
W72-04877 6F

FLOOD DAMAGES
Evaluation of Radar and Raingage Systems for Flood Forecasting,
W72-04966 2B

FLOOD FORECASTING
A Flood-Frequency Relation Based on Regional Record Maxima,
W72-04797 2E

Evaluation of Radar and Raingage Systems for Flood Forecasting,
W72-04966 2B

FLOOD INUNDATION
Floods on Yahara River, Lake Kegonsa Dam to County Line, Dane County, Wisconsin,
W72-04815 4A

FLOOD ROUTING
A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

FLOODPLAINS
The Mill River and Its Floodplain in Northampton and Williamsburg, Mass.: A Study of the Vascular Plant Flora, Vegetation, and the Presence of the Bacterial Family Pseudomonadaceae in Relation to Patterns of Land Us e,
W72-05092 5C

FLOODS
Floods of July 4-8, 1969 in North-Central Ohio,
W72-04852 2E

FLOODWATER
Relation of Ponded Floodwater from Hurricane Beulah to Ground Water in Kleberg, Kenedy, and Willacy Counties, Texas,
W72-04796 2F

FLORIDA
Organochlorine Insecticide Residues in Everglades National Park and Loxahatchee National Wildlife Refuge, Florida,
W72-04799 5B

FLOTATION
Abatement of Pollution From a Poultry Processing Plant,
W72-05006 5D

FLOW
Critical-Depth Flumes for Determining Flow in Canals and Natural Channels,
W72-04871 8B

FLOW MEASUREMENT
Critical-Depth Flumes for Determining Flow in Canals and Natural Channels,
W72-04871 8B

Water Resources Data for Wisconsin, 1969: Part 1. Surface Water Records, and Part 2. Water Quality Records.
W72-05094 7C

FLOW NETS
Inverse Solutions to Three-Dimensional Free Surface Potential Flows,
W72-04808 2F

FLOW PROFILES
Floods on Yahara River, Lake Kegonsa Dam to County Line, Dane County, Wisconsin,
W72-04815 4A

FLOW RATES
Choking and Supercavitating Valves,
W72-04747 8C

Results of a Field Study Using the 3-Axis Doppler Shift Current Meter,
W72-04817 2L

FLUMES
Critical-Depth Flumes for Determining Flow in Canals and Natural Channels,
W72-04871 8B

FLUORIDE IONS
Potassium Fluoride - A Reference Standard for Fluoride Ion Activity,
W72-04741 5A

FLUORIDES
Potassium Fluoride - A Reference Standard for Fluoride Ion Activity,
W72-04741 5A

FLUOROMETRY
Selenium in Lake Sediments - Analytical Procedure and Preliminary Results,
W72-04733 5A

FORECASTING
Space-Time Sampling of Ecological Systems,
W72-04779 6A

A Method for Predicting Peak Flows From Small Rural Vermont Watersheds,
W72-04897 8B

Evaluation of Radar and Raingage Systems for Flood Forecasting,
W72-04966 2B

Analysis of Turbulent Pipe Flow,
W72-05050 8B

Forecasting Planning,
W72-05082 6B

FOUNDATIONS
The Load Movement Behavior of Long Piles,
W72-04872 8D

FREE SURFACES
Inverse Solutions to Three-Dimensional Free Surface Potential Flows,
W72-04808 2F

FREQUENCY ANALYSIS
A Flood-Frequency Relation Based on Regional Record Maxima,
W72-04797 2E

FRESHWATER FISH
Study on the New Strain of the Pathogenic 'Vibrio' Isolated from Freshwater Fishes,
W72-04720 5A

FUTURE PLANNING (PROJECTED)
Forecasting Planning,
W72-05082 6B

GALERKIN PROCEDURE
Application of Galerkin's Procedure to Aquifer Analysis,
W72-05032 2F

GALVESTON COUNTY (TEX)
Records of Wells, Drillers' Logs, and Chemical Analysis of Ground Water in Galveston County, Texas 1952-1970,
W72-04795 4B

GAS CHROMATOGRAPHY
Characterization of Four Major Components in a Technical Polychlorinated Biphenyl Mixture,
W72-04730 5A

Residues of Polychlorobiphenyls in Biological Samples,
W72-04754 5A

GASES
Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

GENERATOR-MOTOR
Field Test Results on Diagonal-Flow Type Reversible Pump-Turbines and Generator-Motors for Takane No. 1 Power Station,
W72-04868 8C

GENERATOR-MOTORS
Reversible Pump/Turbines for Raccoon Mountain,
W72-04874 8C

GEOCHEMICAL MASS BALANCE
Geochemical Mass Balance Among Lithosphere, Hydrosphere, and Atmosphere,
W72-04814 2K

GEOCHEMICAL PROSPECTING
A Geochemical Drainage Survey and Its Implications for Metallogenesis, Central Coast Mountains, British Columbia,
W72-04798 2K

GEOCHEMISTRY
A Geochemical Drainage Survey and Its Implications for Metallogenesis, Central Coast Mountains, British Columbia,
W72-04798 2K

Geochemical Mass Balance Among Lithosphere, Hydrosphere, and Atmosphere,
W72-04814 2K

Complexes of Halloysite with Organic Compounds,
W72-05043 2K

GEOGRAPHIC DISTRIBUTION OF POPULATION
Population Growth in Communities in Relation to Water Resources Policy.
W72-04785 6B

GEOLOGIC FORMATIONS
Farmdalian Lake Deposits and Faunas in Northern Illinois,
W72-04834 2H

GEOLOGIC TIME
Farmdalian Lake Deposits and Faunas in Northern Illinois,
W72-04834 2H

GEOMORPHOLOGY
Morphogenesis of Granitic Boulder Slopes in the Mojave Desert, California,
W72-04813 2J

Application of Stream Order Numbers to the Merrimack River Basin,
W72-05036 4A

GEYSERS
Groundwater Discharge: A Common Generator of Diverse Geologic and Morphologic Phenomena,
W72-04851 2F

GLEY
The Amelioration of Gley and Pseudogley Soils,
W72-04899 2G

GLUTAMIC ACID
Dual Substrate Utilization by Activated Sludge Microflora,
W72-04990 5D

GOALS
The Primacy of our Environment over the Economy,
W72-04887 6B

The Environmental Movement: Ambiguities and Meanings,
W72-05021 6B

Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

GOVERNORS
A New Dimension of State Planning -- Policy Development and Issue Analysis,
W72-05052 6E

GRAPHITE
The Growth of Pores in Graphitized Carbon Reacted with Carbon Dioxide,
W72-04704 5D

GREASE
Pumping Sludge Long Distances,
W72-05013 5D

GREAT LAKES
Agricultural Pollution of the Great Lakes Basin.
W72-04762 5B

Snowfall From Lake-Effect Storms,
W72-04845 2B

GREAT LAKES REGION
The Use, Abuse and Recovery of a Glacial Aquifer,
W72-04802 5B

GREAT PLAINS
Eutrophication of Small Reservoirs in the Great Plains,
W72-04759 5C

Eutrophication of Small Reservoirs in the Great Plains,
W72-04761 5C

GROUNDWATER
Records of Wells, Drillers' Logs, and Chemical Analysis of Ground Water in Galveston County, Texas 1952-1970,
W72-04795 4B

The Use, Abuse and Recovery of a Glacial Aquifer,
W72-04802 5B

Ground-Water Levels in Idaho, 1971.
W72-04819 4B

Ground-Water Pumpage from the Snake Plain Aquifer, Southeastern Idaho,
W72-04820 4B

Hydrologic Data for Horseshoe Lake, Arkansas, and Vicinity,
W72-04822 7C

Estimated Subsidence in the Raymond Basin, Los Angeles County, California, for a Postulated Water-Level Lowering, 1970-2020,
W72-04823 4B

Hydrogeology and Hydrodynamics of Groundwater (Gidrogeologiya i gidrodinamika podzemnykh vod),
W72-04832 2F

Water Chemistry of the Santa Clara Valley, California,
W72-04835 2K

Progress Report on the Analog Model Study of the Magothy Aquifer in the Annapolis, Maryland Area.
W72-04840 4B

Records of Wells, Springs, and Test Borings, Chemical Analyses of Water, Sediment Analyses, Standard Streamflow Data Summaries, and Selected Drillers' Logs From The Little Kanawha River Basin in West Virginia,
W72-04841 7C

Descriptions and Chemical Analyses for Selected Wells in the Dos Palos-Kettleman City area, San Joaquin Valley, California,
W72-04843 2K

Hydrologic Data for the San Luis Valley, Colorado,
W72-05025 7C

Groundwater Law, Management and Administration,
W72-05101 6E

Water Conservation by Reclamation and Recharge,
W72-05140 5D

GROUNDWATER (MAGOTHY AQUIFER)
Progress Report on the Analog Model Study of the Magothy Aquifer in the Annapolis, Maryland Area.
W72-04840 4B

GROUNDWATER MINING
Groundwater Law, Management and Administration,
W72-05101 6E

GROUNDWATER MOVEMENT
Relation of Ponded Floodwater from Hurricane Beulah to Ground Water in Kleberg, Kenedy, and Willacy Counties, Texas,
W72-04796 2F

Finite Difference Solutions of Axisymmetric Infiltration Through Partially Saturated Porous Media,
W72-04805 2G

Inverse Solutions to Three-Dimensional Free Surface Potential Flows,
W72-04808 2F

Water Chemistry of the Santa Clara Valley, California,
W72-04835 2K

Application of Galerkin's Procedure to Aquifer Analysis,
W72-05032 2F

Groundwater Flow in a Sandy Tidal Beach: Two-Dimensional Finite Element Analysis,
W72-05033 2F

Seepage Through Saturated and Unsaturated Layers,
W72-05045 2G

GROUNDWATER POLLUTION
Handling Livestock Waste,
W72-05057 5D

GROUTING
Experimental Cationic Asphalt Emulsion Grouting,
W72-04869 8G

GROWTH CENTERS
Population Growth in Communities in Relation to Water Resources Policy.
W72-04785 6B

GROWTH RATES
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

GROWTH REACTORS
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

GROWTH STAGES
Effects of Sodium Chloride on Outgrowth and Toxin Production of Clostridium botulinum Type E in cod Homogenates,
W72-04737 5C

HALLOYSITE
Complexes of Halloysite with Organic Compounds,
W72-05043 2K

HALOGENS
Amoebic Cysticidal Properties of Halogens in Water,
W72-04746 5F

HALSEY (OREGON)
Toughest Air/Water Rules Met by New Kraft Mill at Halsey, Oregon,
W72-04993 5D

HARD SCIENCES
The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

HAZARDS
Industrial Spill Control and Pollution Incident Prevention,
W72-05017 5G

HEADWORKS
Peaking-Station Layouts on Himalayan Rivers,
W72-04875 4A

HEAT
A Survey of Alternate Methods for Cooling Condenser Discharge Water, Total Community Considerations in the Utilization of Rejected Heat,
W72-04830 5D

HEAT TRANSFER
Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

HEAVY METALS
Histological and Hematological Responses of an Estuarine Teleost to Cadmium,
W72-04709 5C

The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

HEMISPHERICAL RADIATION
Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

HENS
Economics of Dried Poultry Waste (DPW) as a Feed Ingredient or a Fertilizer,
W72-05060 5E

HERBICIDE
Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

HERBICIDE TREATMENT
Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

HERBICIDES
Biological Treatment of Chlorophenolic Wastes.
W72-04825 5D

New Landmark in the White Mountains,
W72-05080 2A

HIGH HEAD
Single-Stage, 500 M High-Head Reversible Pump-Turbines and Generator-Motors for Numappara Power Station,
W72-04867 8C

HISTORIC FLOOD
Floods of July 4-8, 1969 in North-Central Ohio,
W72-04852 2E

HOLOGRAPHY
Structural Measurements With Holographic Interferometry,
W72-04865 8A

Laser Holography and Interferometry in Materials Research,
W72-04873 7B

HOPS
Phosphorus Fertilization of Hops,
W72-05148 5B

HORSESHOE LAKE (ARK)
Hydrologic Data for Horseshoe Lake, Arkansas, and Vicinity,
W72-04822 7C

HUMAN POPULATION
The Primacy of our Environment over the Economy,
W72-04887 6B

HUNGRY HORSE RESERVOIR (MONT)
Hydrology of Hungry Horse Reservoir, Northwestern Montana,
W72-04821 4A

HURRICANE BEULAH
Relation of Ponded Floodwater from Hurricane Beulah to Ground Water in Kleberg, Kenedy, and Willacy Counties, Texas,
W72-04796 2F

HYDRATES
Complexes of Halloysite with Organic Compounds,
W72-05043 2K

HYDRAULIC LOADING
Redesigning Existing Facilities to Increase Hydraulic and Organic Loading,
W72-05004 5D

HYDROBIOLOGY
Formation of Phytoplankton in the Bratsk Reservoir (Formirovaniye fitoplanktona Bratskogo vodokhranilishcha),
W72-04855 5C

HYDRODYNAMICS
Hydrogeology and Hydrodynamics of Groundwater (Gidrogeologiya i gidrodinamika podzemnykh vod),
W72-04832 2F

HYDROGEN ISOTOPES
Hydrogen Isotope Ratios in a Recycling System,
W72-04967 5D

HYDROGEOLOGY
Hydrogeology and Hydrodynamics of Groundwater (Gidrogeologiya i gidrodinamika podzemnykh vod),
W72-04832 2F

Resistivity Soundings in the Condroz (Belgium) With Schlumberger and Dipole Arrays; Application to Limestone Aquifer Evaluation,
W72-04850 2F

Hydrologic Data for the San Luis Valley, Colorado,
W72-05025 7C

Groundwater Law, Management and Administration,
W72-05101 6E

HYDROLOGIC CYCLE
Water Balance and Regionalization of Drainage in the Turkmen SSR (Vodnyy balans i rayonirovaniye drenazha v Turkmenskoy SSR), W72-04861 4A

New Landmark in the White Mountains, W72-05080 2A

HYDROLOGIC DATA
Analysis of Colombian Precipitation to Estimate Irrigation Requirements, W72-04806 2B

Hydrology of Hungry Horse Reservoir, Northwestern Montana, W72-04821 4A

Hydrologic Data for Horseshoe Lake, Arkansas, and Vicinity, W72-04822 7C

Volumetric, Areal, and Tidal Statistics of The Chesapeake Bay Estuary and Its Tributaries, W72-04838 2L

Records of Wells, Springs, and Test Borings, Chemical Analyses of Water, Sediment Analyses, Standard Streamflow Data Summaries, and Selected Drillers' Logs From The Little Kanawha River Basin in West Virginia, W72-04841 7C

Hydrologic Data for the San Luis Valley, Colorado, W72-05025 7C

Streamflow, Groundwater and Ground Response Data--Volume II, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report, W72-05096 7C

HYDROLOGIC EQUATIONS
Forest Transpiration Reduction by Clearcutting and Chemical Treatment, W72-05077 2D

HYDROLOGIC MODELS
A Modular Distributed Model of Catchment Dynamics, W72-04896 2E

HYDROMETEOROLOGY
Hydrometeorology in Precipitation Management, W72-04866 6B

HYDROSOLS (DISPERSIONS)
An Empirical Method for Determining the Concentration of Solids in Suspension, W7204731 5A

HYDROSTATIC PRESSURE
Water Stress Gradients in Plants and Soil-Root Systems, W72-05139 2G

HYPERTROPHIC SOCIETY
Environmental Policy in a Hypertrophic Society, W72-04938 6B

IDAHO
Ground-Water Levels in Idaho, 1971. W72-04819 4B

Ground-Water Pumpage from the Snake Plain Aquifer, Southeastern Idaho, W72-04820 4B

Effects of Siltation and Coarser Sediments on Distribution and Abundance of Stream-Inhabiting Insects, W72-05024 5C

ILLINOIS
Farmdalian Lake Deposits and Faunas in Northern Illinois, W72-04834 2H

INCRUSTATION
The Effects of Electrokinetics Upon Incrustation in Water Wells, W72-04870 8A

INDUSTRIAL WASTES
Forms of Inorganic Nitrogen in Domestic Wastewater, W72-04981 5A

The Economic Feasibility of Treating Textile Wastes in Municipal Systems, W72-04989 5D

Disposal of Insulation Board Mill Effluent by Land Irrigation, W72-05002 5D

Abatement of Pollution From a Poultry Processing Plant, W72-05006 5D

Analytical Parameters of Petrochemical and Refinery Wastewaters, W72-05014 5D

INFILTRATION
Finite Difference Solutions of Axisymmetric Infiltration Through Partially Saturated Porous Media, W72-04805 2G

INFORMATION REQUIREMENT
Information Requirement for Socio-Ecological Models, W72-05119 6A

INFORMATION SYSTEMS
Environmental Policy: Public Participation and the Open Information System, W72-05132 6E

INFRARED IMAGERY
Thermal Study of the Missouri River in North Dakota Using Infrared Imagery, W72-04824 5B

INFRARED RADIATION
Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides, W72-04738 5A

Thermal Mapping of Selected Sites in the Lake Kinneret Region, W72-04811 7B

The Total Organic Carbon Analyzer and Its Application to Water Research, W72-05001 5A

INFRARED SPECTRA
Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides, W72-04738 5A

INPUT-OUTPUT ANALYSIS
An Intersectoral Programming Model for the Management of the Waste Water Economy of the San Francisco Bay Region, W72-04780 5B

INSECTICIDES
Organochlorine Insecticide Residues in Everglades National Park and Loxahatchee National Wildlife Refuge, Florida, W72-04799 5B

INSTANTANEOUS DEPLETION
Use of 14C-Glucose to Study Substrate Removal by Activated Sludge, W72-04970 5D

INSTITUTIONAL CONSTRAINTS
A New Dimension of State Planning -- Policy Development and Issue Analysis, W72-05052 6E

Environmental Policy: Public Participation and the Open Information System, W72-05132 6E

INSTITUTIONS
Political and Social Accommodation: The Political Process and Environmental Preservation, W72-05083 6E

INSTRUMENTATION
An Active Method for Correcting the Frequency Response of the Temperature Sensors of Oceanological Instruments, W72-04749 7B

The Chesapeake Bay Institute Wave Follower--Part II, W72-04818 7B

The Total Organic Carbon Analyzer and Its Application to Water Research, W72-05001 5A

The Measurement of Small Soil Displacements on a Dutch Hillslope, W72-05040 2G

Wire-Guided Self-Propelled Water Sampler. W72-05042 7B

A Note on Inexpensive Telemetry of River Sediment Concentrations, W72-05049 7B

ESCA--The New Spectroscopy, W72-05051 2K

INTEGRATED MANAGEMENT
Administrative Allocation of Water, W72-04786 6E

INTERFACES
Advanced Organics Removal by Pulsed Adsorption Beds, W72-05005 5D

INTERFEROMETERS
Laser Holography and Interferometry in Materials Research, W72-04873 7B

INVERTEBRATES
Comparison of Some Species Importance Values and Ordination Techniques Used to Analyse Benthic Invertebrate Communities, W72-04716 5A

ION-SELECTIVE ELECTRODES
Potassium Fluoride - A Reference Standard for Fluoride Ion Activity, W72-04741 5A

IONS
Waste Water Treatment Phosphate Removal by Iron Oxide, W72-05041 5D

IOWA
Chlorinated Hydrocarbon Pesticides in Iowa Rivers,
W72-04753 5B

IRKUTSK OBLAST
Natural Conditions and Aquatic Life of the Bratsk Reservoir (Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha).
W72-04853 2H

Seasonal Meteorological Conditions in the Region of the Bratsk Reservoir (Sezonnyye meteorologicheskiye usloviya v rayone Bratskogo vodokhranilishcha),
W72-04854 2H

Formation of Phytoplankton in the Bratsk Reservoir (Formirovaniye fitoplanktona Bratskogo vodokhranilishcha),
W72-04855 5C

Aquatic Bacteria in the Bratsk Reservoir in 1965 (Bakterioplankton Bratskogo vodokhranilishcha v 1965 g.),
W72-04856 2H

Formation of Zooplankton in the Bratsk Reservoir During the First Two Years of Impoundment, 1962-63 (Formirovaniye zooplanktona v pervyye dva goda zapolneniya Bratskogo vodokhranilishcha (1962-1963 gg.)),
W72-04857 2H

Fish Population and Distribution in the Oka River Section of the Bratsk Reservoir (Razmeshcheniye i chislennost' ryb v Okinskoy chasti Bratskogo vodokhranilishcha),
W72-04858 2H

Long-Term Water-Quality Characteristics of the Bratsk Reservoir and Forecast of Organic Matter Accumulation (Mnogoletnyaya kharakteristika formirovaniya kachestva vody i prognoz nakopleniya organicheskogo veshchestva v Bratskom vodok hranilishche),
W72-04859 5C

Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

IRON OXIDES
Waste Water Treatment Phosphate Removal by Iron Oxide,
W72-05041 5D

IRRIGATION WATER
Analysis of Colombian Precipitation to Estimate Irrigation Requirements,
W72-04806 2B

ISOLATION
Isolation and Counting of Athiorhodaceae with Membrane Filters,
W72-04743 5A

ISOTHERMS
Evaluation Criteria for Granular Activated Carbons,
W72-04977 5D

ISSUE ANALYSIS
A New Dimension of State Planning -- Policy Development and Issue Analysis,
W72-05052 6E

JACKSONVILLE (ARK)
Biological Treatment of Chlorophenolic Wastes.
W72-04825 5D

JUDICIAL DECISIONS
Riparian Water Law. A Functional Analysis,
W72-05097 6E

KENOSHA (WISC)
Process Evaluation--Phosphorus Removal,
W72-04979 5D

KINETICS
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

Use of 14C-Glucose to Study Substrate Removal by Activated Sludge,
W72-04970 5D

Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

LABORATORY TESTS
Determination of Tritium in Water by the U.S. Geological Survey, Denver, Colorado,
W72-04842 5A

LAKE BEDS
Farmdalian Lake Deposits and Faunas in Northern Illinois,
W72-04834 2H

LAKE-EFFECT SNOWSTORMS
Snowfall From Lake-Effect Storms,
W72-04845 2B

LAKE MICHIGAN
Coastal Sedimentation of Southeastern Lake Michigan, Field Trip Guidebook,
W72-04807 2J

LAKE RENEWAL
Inland Lake Dredging Evaluation.
W72-04778 8C

LAKE VOMBSJON
Primary Production and Chlorophyll a Content of Nanoplankton in a Eutrophic Lake,
W72-04717 5C

LAKES
Population Dynamics of Selected Zooplankton in Three Oligotrophic Oregon Lakes,
W72-04763 5C

An Artificial Alteration of the Seasonal Cycle of the Plankton Diatom Melosira Italica Subsp Subarctica in an English Lake,
W72-04765 5C

Inland Lake Dredging Evaluation.
W72-04778 8C

Water Quality Office.
W72-04791 5C

Election Micrographs of Lake Kinneret Sediments,
W72-04810 2J

LAND MANAGEMENT
Ecology and Technology in Twentieth-Century Landscapes,
W72-04980 6B

LAND RECLAMATION
Cost of Reclamation and Mine Drainage Abatement-Elkins Demonstration Project,
W72-05146 5G

LAND SUBSIDENCE
Estimated Subsidence in the Raymond Basin, Los Angeles County, California, for a Postulated Water-Level Lowering, 1970-2020,
W72-04823 4B

LAND USE
The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

The Mill River and its Floodplain in Northampton and Williamsburg, Mass.: A Study of the Vascular Plant Flora, Vegetation, and the Presence of the Bacterial Family Pseudomonadaceae in Relation to Patterns of Land Us e,
W72-05092 5C

LANDSCAPE DESIGN
Ecology and Technology in Twentieth-Century Landscapes,
W72-04980 6B

LANDSCAPING
Ecology and Technology in Twentieth-Century Landscapes,
W72-04980 6B

LASERS
Laser Holography and Interferometry in Materials Research,
W72-04873 7B

LAWRENCE (KANS)
Effects of Urbanization on Storm Water Runoff Quality: A Limited Experiment, Naismith Ditch, Lawrence, Kansas,
W72-05035 4C

LAYOUT
Peaking-Station Layouts on Himalayan Rivers,
W72-04875 4A

LEAD
The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

LEAKAGE
Experimental Cationic Asphalt Emulsion Grouting,
W72-04869 8G

LEGAL ASPECTS
Environmental Policy and the Congress,
W72-05118 6E

LEGISLATION
Process Evaluation--Phosphorus Removal,
W72-04979 5D

LIFE HISTORY STUDIES
Life Histories and Drifting of Three Species of Limnephilidae (Trichoptera),
W72-04714 5A

LIMESTONES
Resistivity Soundings in the Condroz (Belgium) With Schlumberger and Dipole Arrays; Application to Limestone Aquifer Evaluation,
W72-04850 2F

LINEAR FLOOD ROUTING
A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

LINEAR PROGRAMMING
An Intersectoral Programming Model for the Management of the Waste Water Economy of the San Francisco Bay Region,
W72-04780 5B

LIPIDS
Expanded Program for Pesticide Monitoring of Fish,
W72-04740 5A

LIQUID CHROMATOGRAPHY
Determination of Nitrilotriacetic Acid by High-Speed Ion Exchange Chromatography,
W72-04901 5A

LIQUID DILUTION
The Quantitative Determination of the Odor Strength of Chicken Manure,
W72-05069 5A

LIQUID SCINTILLATION TECHNIQUES
Determination of Tritium in Water by the U.S. Geological Survey, Denver, Colorado,
W72-04842 5A

LIQUID WASTES
Auxiliary Sewage Storage System for Temporarily Storing Sewage,
W72-05022 5D

LITERATURE REVIEW
The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

LITTLE KANAWHA RIVER BASIN (W VA)
Records of Wells, Springs, and Test Borings, Chemical Analyses of Water, Sediment Analyses, Standard Streamflow Data Summaries, and Selected Drillers' Logs From The Little Kanawha River Basin in West Virginia,
W72-04841 7C

LOGGING (RECORDING)
Records of Wells, Drillers' Logs, and Chemical Analysis of Ground Water in Galveston County, Texas 1952-1970,
W72-04795 4B

LONG ISLAND (N.Y.)
Catalog of Recharge Basins on Long Island, N.Y., In 1969,
W72-04833 4A

LONG-TERM PLANNING
Making Water Resources Planning Relevant,
W72-04881 6B

The Primacy of our Environment over the Economy,
W72-04887 6B

Improving the Planning Process--Establishing Values,
W72-04888 6B

LONG TERM RESEARCH PROGRAM
Where Will All the People Go. How Much Will They Dump When They Get There -- Population Distribution, Environmental Damage, and the Quality of Life,
W72-05123 6B

LOW-FLOW AUGMENTATION
Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

LPP VIRUS
Distribution of Blue-Green Algal Viruses in Various Types of Natural Waters,
W72-04736 5B

LYSIMETERS
Plant Growth-Evapotranspiration Relations for Several Crops in the Central Great Plains,
W72-05147 2D

MADISON (WISC)
Forms of Inorganic Nitrogen in Domestic Wastewater,
W72-04981 5A

MANAGEMENT
Public Participation and Environmental Quality,
W72-04839 6A

Alternatives in Water Management,
W72-04893 6B

The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

Urban Social Theory and Research,
W72-05121 6B

Environmental Policy: Public Participation and the Open Information System,
W72-05132 6E

MARICULTURE
Bibliography of Aquaculture.
W72-05087 5C

MARINE ALGAE
Cultural Estimation of Yeasts on Seaweeds,
W72-04748 5A

The Distribution and Net Productivity of Sublittoral Populations of Attached Macrophytic Algae in an Estuary on the Atlantic Coast of Spain,
W72-04766 5C

MARINE PLANTS
Diurnal Rhythms in Netplankton and Nannoplankton Assimilation Ratios,
W72-04770 5C

MARSH PLANTS
The Mill River and Its Floodplain in Northampton and Williamsburg, Mass.: A Study of the Vascular Plant Flora, Vegetation, and the Presence of the Bacterial Family Pseudomonadaceae in Relation to Patterns of Land Us e,
W72-05092 5C

MARYLAND
Progress Report on the Analog Model Study of the Magothy Aquifer in the Annapolis, Maryland Area.
W72-04840 4B

MASS BALANCE
Use of 14C-Glucose to Study Substrate Removal by Activated Sludge,
W72-04970 5D

MASS SPECTROSCOPY
Residues of Polychlorobiphenyls in Biological Samples,
W72-04754 5A

MASS WASTING
The Measurement of Small Soil Displacements on a Dutch Hillslope,
W72-05040 2G

MASSACHUSETTS
Application of Stream Order Numbers to the Merrimack River Basin,
W72-05036 4A

MATERIALS TESTS
Laser Holography and Interferometry in Materials Research,
W72-04873 7B

MATHEMATIC MODELS
Survival of Coliform Bacteria in Wastewater Treatment Lagoons,
W72-04976 5D

MATHEMATICAL ANALYSIS
The Vibrations of Transmission Line Conductor Bundles,
W72-04863 8C

MATHEMATICAL MODELS
Finite Difference Solutions of Axisymmetric Infiltration Through Partially Saturated Porous Media,
W72-04805 2G

Hymo, A Problem-Oriented Computer Language for Building Hydrologic Models,
W72-05028 7C

Effects of Random Data Errors on the Parameter Values for a Conceptual Model,
W72-05029 7A

MATHEMATICAL STUDIES
Analysis of Turbulent Pipe Flow,
W72-05050 8B

MELOSIRA ITALICA
An Artificial Alteration of the Seasonal Cycle of the Plankton Diatom Melosira Italica Subsp Subarctica in an English Lake,
W72-04765 5C

MEMBRANE PROCESSES
Isolation and Counting of Athiorhodaceae with Membrane Filters,
W72-04743 5A

MERCURY
Trace Elements and Compounds in Waters,
W72-04969 5F

MERRIMACK RIVER (MASS)
Application of Stream Order Numbers to the Merrimack River Basin,
W72-05036 4A

METABOLISM
Use of 14C-Glucose to Study Substrate Removal by Activated Sludge,
W72-04970 5D

METABOLIZEABLE ENERGY
The Metabolizeable Energy Value of Dried Poultry Waste,
W72-05065 5E

METEOROLOGICAL DATA
Development of a Procedure for Determining Spacial and Time Variations of Precipitation in Venezuela,
W72-04804 2B

Seasonal Meteorological Conditions in the Region of the Bratsk Reservoir (Sezonnyye

meteorologicheskiye usloviya v rayone Bratskogo vodokhranilishcha),
W72-04854 2H

Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

METEOROLOGY
Seasonal Meteorological Conditions in the Region of the Bratsk Reservoir (Sezonnyye meteorologicheskiye usloviya v rayone Bratskogo vodokhranilishcha),
W72-04854 2H

Some Results of Hydromteorological Research Work Carried Out in The Experimental Basins of the Meteorological Service of German Democratic Republic,
W72-05046 2A

Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

Concepts of Soil Moisture Availability and Their Effect on Soil Moisture Estimates from a Meteorological Budget,
W72-05149 2D

METHANE
Method For the Storage of Samples For Dissolved Gas Analyses,
W72-04729 5A

METHANOL
Nitrification and Denitrification in Activated Sludge Systems,
W72-05019 5D

MICROORGANISMS
Identification of Filamentous Microorganisms in Activated Sludge,
W72-04984 5B

MICROSTRAINING
Microstraining of Combined Sewer Overflows,
W72-04971 5D

Microstraining Paper Mill Wastewater,
W72-04996 5D

MILL RIVER (MASS)
The Mill River and Its Floodplain in Northampton and Williamsburg, Mass.: A Study of the Vascular Plant Flora, Vegetation, and the Presence of the Bacterial Family Pseudomonadaceae in Relation to Patterns of Land Us e,
W72-05092 5C

MINERALOGY
Complexes of Halloysite with Organic Compounds,
W72-05043 2K

MIXING
Effect of Upwelling, Mixing, and High Primary Productivity on CO2 Concentrations in Surface Waters of the Bering Sea,
W72-05038 2K

MODEL STUDIES
Space-Time Sampling of Ecological Systems,
W72-04779 6A

Statistical Geometry of Porous Media,
W72-04783 2G

Agricultural Flood Damage Assessment: A Review and Investigation of a Simulation Method,
W72-04877 6F

A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

On the Generation of Long Waves,
W72-05039 2E

Analysis of Turbulent Pipe Flow,
W72-05050 8B

Numerical Modeling of Unsaturated Groundwater Flow Including Effects of Evapotranspiration,
W72-05089 2G

Information Requirement for Socio-Ecological Models,
W72-05119 6A

MOISTURE AVAILABILITY
Concepts of Soil Moisture Availability and Their Effect on Soil Moisture Estimates from a Meteorological Budget,
W72-05149 2D

MOLLUSKS
Bibliography of Aquaculture.
W72-05087 5C

MONITORING
Expanded Program for Pesticide Monitoring of Fish,
W72-04740 5A

An Empirical Method for Determining the Concentration of Solids in Suspension,
W7204731 5A

MONTANA
Hydrology of Hungry Horse Reservoir, Northwestern Montana,
W72-04821 4A

MONTMORILLONITE
Cation Exchange Selectivity of Some Clay-Sized Minerals and Soil Materials,
W72-05127 2K

MOST PROBABLE NUMBER
Survival of Coliform Bacteria in Wastewater Treatment Lagoons,
W72-04976 5D

MUNICIPAL WASTES
Forms of Inorganic Nitrogen in Domestic Wastewater,
W72-04981 5A

The Economic Feasibility of Treating Textile Wastes in Municipal Systems,
W72-04989 5D

Dual Substrate Utilization by Activated Sludge Microflora,
W72-04990 5D

NAIROBI (KENYA)
Rainfall and Run-off from an Industrial Area in Nairobi, Kenya,
W72-04837 4C

NANOPLANKTON
Primary Production and Chlorophyll a Content of Nanoplankton in a Eutrophic Lake,
W72-04717 5C

NATIONAL WATER COMMISSION
A New Look at National Water Policy,
W72-04882 6B

NATIONAL WATER POLICY
A National Policy for Western Water Development,
W72-04895 6B

NATURAL FLOW DOCTRINE
Riparian Water Law. A Functional Analysis,
W72-05097 6E

NET RADIATION
Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

NETPLANKTON
Diurnal Rhythms in Netplankton and Nannoplankton Assimilation Ratios,
W72-04770 5C

NEUTRON ACTIVATION ANALYSIS
Trace Element Analysis of Environmental Samples by Neutron Activation Method,
W72-04998 5A

NEW COMMUNITIES
Nuclear Energy for a New Town,
W72-05091 6G

NEW ENGLAND WATERSHED HISTORY
New Landmark in the White Mountains,
W72-05080 2A

NEW LANDMARK
New Landmark in the White Mountains,
W72-05080 2A

NEW TOWNS
Population Growth in Communities in Relation to Water Resources Policy.
W72-04785 6B

NEW YORK
Catalog of Recharge Basins on Long Island, N.Y., In 1969,
W72-04833 4A

NITRATES
Probable Impact of NTA on Ground Water,
W72-04800 5B

The Formation of Nitrate from Ammonium Nitrogen in Soils: IV. Use of the Delay and Maximum Rate Phases for Making Quantitative Predictions,
W72-05120 5B

NITRIFICATION
Nitrification and Denitrification in Activated Sludge Systems,
W72-05019 5D

The Formation of Nitrate from Ammonium Nitrogen in Soils: IV. Use of the Delay and Maximum Rate Phases for Making Quantitative Predictions,
W72-05120 5B

NITRILOTRIACETIC ACID
Probable Impact of NTA on Ground Water,
W72-04800 5B

Determination of Nitrilotriacetic Acid by High-Speed Ion Exchange Chromatography,
W72-04901 5A

NITROGEN
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

Forms of Inorganic Nitrogen in Domestic Wastewater,
W72-04981 5A

Toxic Effects of Ammonia Nitrogen in High-Rate Digestion,
W72-05015 5D

A Comparison of Nitrogen Losses From Urea and Ammonium Nitrate in Surface Runoff Water,
W72-05142 5B

NO LOGGING
Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

NTA
Determination of Nitrilotriacetic Acid by High-Speed Ion Exchange Chromatography,
W72-04901 5A

NUCLEAR POWER PLANTS
Nuclear Energy for a New Town,
W72-05091 6G

NUCLEAR POWERPLANTS
Thermal Study of the Missouri River in North Dakota Using Infrared Imagery,
W72-04824 5B

NUMAPPARA POWER STATION
Single-Stage, 500 M High-Head Reversible Pump-Turbines and Generator-Motors for Numappara Power Station,
W72-04867 8C

NUMERICAL ANALYSIS
Inverse Solutions to Three-Dimensional Free Surface Potential Flows,
W72-04808 2F

Cation Adsorption in One-Dimensional Flow Through Soils: A Numerical Solution,
W72-05031 2G

Application of Galerkin's Procedure to Aquifer Analysis,
W72-05032 2F

Groundwater Flow in a Sandy Tidal Beach: Two-Dimensional Finite Element Analysis,
W72-05033 2F

Numerical Modeling of Unsaturated Groundwater Flow Including Effects of Evapotranspiration,
W72-05089 2G

NUTRIENT LOSS VIA STREAM
Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

NUTRIENT REQUIREMENTS
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

NUTRIENTS
Earth Resource Technology Used in Pollution Detection,
W72-04742 5A

Nutrient Removal by Waterhyacinth,
W72-04776 5C

Nutrients and Carbon Dioxide in the Columbia River,
W72-04974 5B

Algal-Bacterial Symbiosis for Removal and Conservation of Wastewater Nutrients,
W72-04983 5D

OBSERVATION WELLS
Ground-Water Levels in Idaho, 1971.
W72-04819 4B

OCEAN CIRCULATION
On the Generation of Long Waves,
W72-05039 2E

OCEAN WAVES
The Chesapeake Bay Institute Wave Follower--Part II,
W72-04818 7B

On the Generation of Long Waves,
W72-05039 2E

OCEANOGRAPHY
The Chesapeake Bay Institute Wave Follower--Part II,
W72-04818 7B

On the Generation of Long Waves,
W72-05039 2E

OCEANS
Effect of Upwelling, Mixing, and High Primary Productivity on CO2 Concentrations in Surface Waters of the Bering Sea,
W72-05038 2K

Wire-Guided Self-Propelled Water Sampler.
W72-05042 7B

ODESSA (TEXAS)
Multiple Water Reuse,
W72-04994 5D

ODOR
Poultry Pollution: Research Results,
W72-05058 5E

Economics of Dried Poultry Waste (DPW) as a Feed Ingredient or a Fertilizer,
W72-05060 5E

Drying of Poultry Manure in a Cage-Layer House,
W72-05063 5E

Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

The Qualitative Determination of the Odor Quality of Chicken Manure,
W72-05068 5B

The Quantitative Determination of the Odor Strength of Chicken Manure,
W72-05069 5A

Particulate Matter,
W72-05072 5A

Odor Controls by Chemical Treatment,
W72-05074 5D

ODOR CONTROL
Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

Soil Filtration to Remove Odors,
W72-05073 5D

Odor Controls by Chemical Treatment,
W72-05074 5D

OHIO
Floods of July 4-8, 1969 in North-Central Ohio,
W72-04852 2E

OHM'S LAW
Numerical Modeling of Unsaturated Groundwater Flow Including Effects of Evapotranspiration,
W72-05089 2G

OIL CONTAINMENT SYSTEMS
Oil Spill Containment Systems.
W72-04826 5G

OIL SLICKS
Oil Spill Containment Systems.
W72-04826 5G

OIL WASTES
Oil Spill Containment Systems.
W72-04826 5G

OILS
Earth Resource Technology Used in Pollution Detection,
W72-04742 5A

OLIGOTROPHY
Population Dynamics of Selected Zooplankton in Three Oligotrophic Oregon Lakes,
W72-04763 5C

ON-SITE DATA COLLECTIONS
Space-Time Sampling of Ecological Systems,
W72-04779 6A

ON-SITE INVESTIGATIONS
Redesigning Existing Facilities to Increase Hydraulic and Organic Loading,
W72-05004 5D

OPERATIONS RESEARCH
A Computerized Educational Program for the Application of the Management Sciences to Water Resource Management,
W72-05088 7C

OPTICAL MEASUREMENT
Laser Holography and Interferometry in Materials Research,
W72-04873 7B

OPTIMIZATION
Algebraic Technological Function from a Simulation Model,
W72-05034 6A

ORDINATION
Comparison of Some Species Importance Values and Ordination Techniques Used to Analyse Benthic Invertebrate Communities,
W72-04716 5A

ORGANIC LOADING
Design and Operation of an Extended Aeration Plant,
W72-04973 5D

Redesigning Existing Facilities to Increase Hydraulic and Organic Loading,
W72-05004 5D

ORGANIC MATTER
Long-Term Water-Quality Characteristics of the Bratsk Reservoir and Forecast of Organic Matter Accumulation (Mnogoletnyaya kharakteristika formirovaniya kachestva vody i prognoz nakopleniya organicheskogo veshchestva v Bratskom vodok hranilishche),
W72-04859 5C

Advanced Organics Removal by Pulsed Adsorption Beds,
W72-05005 5D

ORGANOPHOSPHORUS PESTICIDES
Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides,
W72-04738 5A

OSTRACODS
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

OVERFLOW
Demonstration of Rotary Screening for Combined Sewer Overflows.
W72-04827 5D

OXIDATION
Operational Stability of the Extended Aeration Process,
W72-04784 5D

Dual Substrate Utilization by Activated Sludge Microflora,
W72-04990 5D

OXIDATION LAGOONS
Some Observations on the Limnology of a Pond Receiving Animal Wastes,
W72-04773 5C

Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

Biological Treatment of Chlorophenolic Wastes.
W72-04825 5D

Survival of Coliform Bacteria in Wastewater Treatment Lagoons,
W72-04976 5D

OXIDATION-REDUCTION POTENTIAL
Energy Production in Anaerobic Organisms,
W72-05018 5D

PACIFIC COD
Effects of Sodium Chloride on Outgrowth and Toxin Production of Clostridium botulinum Type E in cod Homogenates,
W72-04737 5C

PACKAGE PLANTS
Design and Operation of an Extended Aeration Plant,
W72-04973 5D

PALEOCLIMATOLOGY
Morphogenesis of Granitic Boulder Slopes in the Mojave Desert, California,
W72-04813 2J

PARTICULATE MATTER
Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

Particulate Matter,
W72-05072 5A

PATENTS
Auxiliary Sewage Storage System for Temporarily Storing Sewage,
W72-05022 5D

Waste Water Treatment Phosphate Removal by Iron Oxide,
W72-05041 5D

PATH OF POLLUTANTS
Dieldrin Levels in Fish From Iowa Streams,
W72-04739 5A

Probable Impact of NTA on Ground Water,
W72-04800 5B

Methods of Geologic Evaluation of Pollution Potential at Mountain Homesites,
W72-04803 5B

PATHOGENIC BACTERIA
Study on the New Strain of the Pathogenic 'Vibrio' Isolated from Freshwater Fishes,
W72-04720 5A

PATTERNS
Forecasting Planning,
W72-05082 6B

PATUXENT ESTUARY (MD)
Results of a Field Study Using the 3-Axis Doppler Shift Current Meter,
W72-04817 2L

PEAK ACCUMULATION
Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

PEAK DISCHARGE
Floods of July 4-8, 1969 in North-Central Ohio,
W72-04852 2E

A Method for Predicting Peak Flows From Small Rural Vermont Watersheds,
W72-04897 8B

PEAK FLOWS
Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

PEAK POWER
Peaking-Station Layouts on Himalayan Rivers,
W72-04875 4A

PENETRATION
Soil Moisture Content, Tilth, and Soybean Response with Surface and Subsurface Drainage,
W72-05145 2G

PERMITS
Administrative Allocation of Water,
W72-04786 6E

PESTICIDE RESIDUES
DDT in Forest Streams,
W72-04719 5B

Characterization of Four Major Components in a Technical Polychlorinated Biphenyl Mixture,
W72-04730 5A

Expanded Program for Pesticide Monitoring of Fish,
W72-04740 5A

Residues of Polychlorobiphenyls in Biological Samples,
W72-04754 5A

PESTICIDES
Organochlorine Insecticide Residues in Everglades National Park and Loxahatchee National Wildlife Refuge, Florida,
W72-04799 5B

Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

PHENOLS
Biological Treatment of Chlorophenolic Wastes.
W72-04825 5D

PHILADELPHIA (PENN)
Microstraining of Combined Sewer Overflows,
W72-04971 5D

PHOSPHATE EQUILIBRIA
Phosphate Equilibria on Stream Sediment and Soil in a Watershed Draining an Agricultural Region,
W72-04774 5C

PHOSPHATES
Strategies for Control of Man-Made Eutrophication,
W72-04734 5D

Phosphate Equilibria on Stream Sediment and Soil in a Watershed Draining an Agricultural Region,
W72-04774 5C

Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

Phosphorus Removal by Luxury Uptake,
W72-05011 5D

Waste Water Treatment Phosphate Removal by Iron Oxide,
W72-05041 5D

PHOSPHORUS
Levels of Inorganic and Total Phosphorus in Lake Sediments as Related to Other Sediment Parameters,
W72-04732 5C

Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

Operation of Conventional Activated Sludge for Maximum Phosphorus Removal,
W72-04978 5D

Process Evaluation--Phosphorus Removal,
W72-04979 5D

Phosphorus Removal - The State of the Art,
W72-05131 5D

Phosphorus Fertilization of Hops,
W72-05148 5B

PHOTOGRAPHY
Pollution Detection by Remote Sensing.
W72-04726 5A

PHOTOSYNTHESIS
Diurnal Rhythms in Netplankton and Nannoplankton Assimilation Ratios,
W72-04770 5C

PHYSICAL ENVIRONMENT
Planning for People, Not Buildings,
W72-05133 6B

PHYTOMACROFAUNA
A Quantitative Sampler for Aquatic Phytomacrofauna,
W72-04710 5A

PHYTOPLANKTON
Primary Production and Chlorophyll a Content of Nanoplankton in a Eutrophic Lake,
W72-04717 5C

Formation of Phytoplankton in the Bratsk Reservoir (Formirovaniye fitoplanktona Bratskogo vodokhranilishcha),
W72-04855 5C

PILE FOUNDATIONS
The Load Movement Behavior of Long Piles,
W72-04872 8D

PILES (FOUNDATIONS)
The Load Movement Behavior of Long Piles,
W72-04872 8D

PILOT PLANTS
Nitrification and Denitrification in Activated Sludge Systems,
W72-05019 5D

PIPE FLOW
Analysis of Turbulent Pipe Flow,
W72-05050 8B

PIPES
Pumping Sludge Long Distances,
W72-05013 5D

PLANKTON
A Quantitative Plankton Sampler,
W72-04713 7B

An Artificial Alteration of the Seasonal Cycle of the Plankton Diatom Melosira Italica Subsp Subarctica in an English Lake,
W72-04765 5C

Diurnal Rhythms in Netplankton and Nannoplankton Assimilation Ratios,
W72-04770 5C

PLANNING
Community Decision Behavior: The Culture of Planning,
W72-04760 6A

Water and Western Destiny: From Conflict to Cooperation.
W72-04878 6B

A Review of Inter-Regional and International Water Transfer Proposals,
W72-04883 6B

A Look Ahead in Planning Coordination and Policy Making,
W72-04884 6B

The Third Western Interstate Water Conference of Colorado State University,
W72-04886 6B

Partial Solutions--The Outlook,
W72-04890 6B

The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

A New Dimension of State Planning -- Policy Development and Issue Analysis,
W72-05052 6E

Cooperation of Government, Science, and Industry in Research and Development - A Systems View,
W72-05075 6B

Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

Planning for People, Not Buildings,
W72-05133 6B

PLAYAS
Soil-Desiccation Features in South Dakota Depressions,
W72-04812 2G

PLECTONEMA BORYANIUM
Distribution of Blue-Green Algal Viruses in Various Types of Natural Waters,
W72-04736 5B

POISON
A New Concept in Sample Preservation--Poisoning and Depoisoning,
W72-05012 5A

POLAROGRAPHIC ANALYSIS
An Empirical Method for Determining the Concentration of Solids in Suspension,
W7204731 5A

POLICY
Environmental Policy and Politics: Value and Power Context,
W72-04985 6B

Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

Environmental Policy and the Congress,
W72-05118 6E

Environmental Policy: Public Participation and the Open Information System,
W72-05132 6E

POLICY DEVELOPMENT
A New Dimension of State Planning -- Policy Development and Issue Analysis,
W72-05052 6E

POLICY MAKING
The Social Context of Urban Planning,
W72-04758 6B

A Look Ahead in Planning Coordination and Policy Making,
W72-04884 6B

A New Dimension of State Planning -- Policy Development and Issue Analysis,
W72-05052 6E

POLITICAL ASPECTS
Environmental Policy in a Hypertrophic Society,
W72-04938 6B

Environmental Policy and Politics: Value and Power Context,
W72-04985 6B

Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

Planning for People, Not Buildings,
W72-05133 6B

POLITICAL CONSTRAINTS
Making Water Resources Planning Relevant,
W72-04881 6B

The Primacy of our Environment over the Economy,
W72-04887 6B

Environmental Policy and Politics: Value and Power Context,
W72-04985 6B

Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

POLITICAL PROCESS
Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

POLLUTION ABATEMENT
Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

POLYCHLORINATED BIPHENYLS
Characterization of Four Major Components in a Technical Polychlorinated Biphenyl Mixture,
W72-04730 5A

Residues of Polychlorobiphenyls in Biological Samples,
W72-04754 5A

POLYELECTROLYTES
Microstraining Paper Mill Wastewater,
W72-04996 5D

POLYMERS
Polymers in the Filtration of Raw Sludge,
W72-04968 5D

PONDING
Relation of Ponded Floodwater from Hurricane Beulah to Ground Water in Kleberg, Kenedy, and Willacy Counties, Texas,
W72-04796 2F

PONDS
An Engineering-Economic Study of Cooling Pond Performance.
W72-04831 5D

POPULATION
Some Social Issues and Alternatives Involved in Planning Water Resources with People in the West,
W72-04889 6B

Where Will All the People Go. How Much Will They Dump When They Get There -- Population Distribution, Environmental Damage, and the Quality of Life,
W72-05123 6B

POPULATION DISPERSAL
Population Growth in Communities in Relation to Water Resources Policy.
W72-04785 6B

POPULATION DISTRIBUTION
Where Will All the People Go. How Much Will They Dump When They Get There -- Population Distribution, Environmental Damage, and the Quality of Life,
W72-05123 6B

PORES
The Growth of Pores in Graphitized Carbon Reacted with Carbon Dioxide,
W72-04704 5D

POROSITY
Statistical Geometry of Porous Media,
W72-04783 2G

POROUS MEDIA
Statistical Geometry of Porous Media,
W72-04783 2G

Finite Difference Solutions of Axisymmetric Infiltration Through Partially Saturated Porous Media,
W72-04805 2G

Inverse Solutions to Three-Dimensional Free Surface Potential Flows,
W72-04808 2F

Numerical Modeling of Unsaturated Groundwater Flow Including Effects of Evapotranspiration,
W72-05089 2G

POTABLE WATER
Trace Elements and Compounds in Waters,
W72-04969 5F

POTAMOCYPRIS
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

POTASSIUM FLUORIDE
Potassium Fluoride - A Reference Standard for Fluoride Ion Activity,
W72-04741 5A

POTHOLES
Soil-Desiccation Features in South Dakota Depressions,
W72-04812 2G

POULTRY
Abatement of Pollution From a Poultry Processing Plant,
W72-05006 5D

Block Drying of Chicken Manure,
W72-05054 5D

Poultry Pollution: Research Results,
W72-05058 5E

Early Experiments at Michigan State University Involving the Use of Chicken Manure,
W72-05059 5E

Feeding Dehydrated Poultry Waste to Dairy Cows,
W72-05061 5E

Drying of Poultry Manure in a Cage-Layer House,
W72-05063 5E

Dried Poultry Waste as a Protein Source for Feedlot Cattle,
W72-05064 5E

Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

The Qualitative Determination of the Odor Quality of Chicken Manure,
W72-05068 5B

Analyses of Gases Encountered in a Commercial Poultry House,
W72-05070 5A

Particulate Matter,
W72-05072 5A

PRECIPITATION
Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

PRECIPITATION (ATMOSPHERIC)
Development of a Procedure for Determining Spacial and Time Variations of Precipitation in Venezuela,
W72-04804 2B

Analysis of Colombian Precipitation to Estimate Irrigation Requirements,
W72-04806 2B

Hydrometeorology in Precipitation Management,
W72-04866 6B

A Truncated Square-Root-Normal Distribution Applied to Monthly Precipitation Totals for Ghent (Belgium),
W72-05048 2B

Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

PRESCRIPTIVE RIGHTS
Riparian Water Law. A Functional Analysis,
W72-05097 6E

PRESERVATION
A New Concept in Sample Preservation--Poisoning and Depoisoning,
W72-05012 5A

PRIMARY PRODUCTION
Primary Production and Chlorophyll a Content of Nanoplankton in a Eutrophic Lake,
W72-04717 5C

PRIMARY SLUDGE
Pumping Sludge Long Distances,
W72-05013 5D

PRIORITIES
Environmental Policy in a Hypertrophic Society,
W72-04938 6B

Planning for People, Not Buildings,
W72-05133 6B

PROBABILITY
Agricultural Flood Damage Assessment: A Review and Investigation of a Simulation Method,
W72-04877 6F

PROCESS CHARACTERIZATION
Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

PROCESS CONTROL
Dual Substrate Utilization by Activated Sludge Microflora,
W72-04990 5D

Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

PROFESSIONALISM
Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

PROGRAMMING LANGUAGES
Hymo, A Problem-Oriented Computer Language for Building Hydrologic Models,
W72-05028 7C

PROJECT BENEFITS
Some Social Issues and Alternatives Involved in Planning Water Resources with People in the West,
W72-04889 6B

PROJECT PLANNING
Improving the Planning Process--Establishing Values,
W72-04888 6B

A National Policy for Western Water Development,
W72-04895 6B

PROTOZOA
Vertical Distribution of Some Ciliated Protozoa in Two Freshwater Sediments,
W72-04718 5C

Amoebic Cysticidal Properties of Halogens in Water,
W72-04746 5F

PSEUDOGLEY
The Amelioration of Gley and Pseudogley Soils,
W72-04899 2G

PSEUDOMONAS
The Mill River and Its Floodplain in Northampton and Williamsburg, Mass.: A Study of the Vascular Plant Flora, Vegetation, and the Presence of the Bacterial Family Pseudomonadaceae in Relation to Patterns of Land Us e,
W72-05092 5C

PUBLIC BENEFITS
Legal Protection of Instream Water Values,
W72-05099 6E

Planning for People, Not Buildings,
W72-05133 6B

PUBLIC GOALS
Planning for People, Not Buildings,
W72-05133 6B

PUBLIC HEALTH
Industrial Spill Control and Pollution Incident Prevention,
W72-05017 5G

PUBLIC INVOLVEMENT
Environmental Policy and the Congress,
W72-05118 6E

PUBLIC PARTICIPATION
Public Participation and Environmental Quality,
W72-04839 6A

Improving the Planning Process--Establishing Values,
W72-04888 6B

Environmental Policy: Public Participation and the Open Information System,
W72-05132 6E

PUBLIC RIGHTS
Legal Protection of Instream Water Values,
W72-05099 6E

Public Access Rights in Waters and Shorelands,
W72-05100 6E

PULP WASTES
Toughest Air/Water Rules Met by New Kraft Mill at Halsey, Oregon,
W72-04993 5D

Microstraining Paper Mill Wastewater,
W72-04996 5D

Disposal of Insulation Board Mill Effluent by Land Irrigation,
W72-05002 5D

PULSED ADSORPTION BEDS
Advanced Organics Removal by Pulsed Adsorption Beds,
W72-05005 5D

PUMP TURBINES
Single-Stage, 500 M High-Head Reversible Pump-Turbines and Generator-Motors for Numappara Power Station,
W72-04867 8C

Field Test Results on Diagonal-Flow Type Reversible Pump-Turbines and Generator-Motors for Takane No. 1 Power Station,
W72-04868 8C

Reversible Pump/Turbines for Raccoon Mountain,
W72-04874 8C

PUMPED STORAGE
Single-Stage, 500 M High-Head Reversible Pump-Turbines and Generator-Motors for Numappara Power Station,
W72-04867 8C

Reversible Pump/Turbines for Raccoon Mountain,
W72-04874 8C

PUMPING
Ground-Water Pumpage from the Snake Plain Aquifer, Southeastern Idaho,
W72-04820 4B

Estimated Subsidence in the Raymond Basin, Los Angeles County, California, for a Postulated Water-Level Lowering, 1970-2020,
W72-04823 4B

Pumping Sludge Long Distances,
W72-05013 5D

QANATS
Qanat Systems in Iran,
W72-04849 4B

QUALITY CONTROL
The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

Where Will All the People Go. How Much Will They Dump When They Get There -- Population Distribution, Environmental Damage, and the Quality of Life,
W72-05123 6B

QUALITY OF LIFE
Where Will All the People Go. How Much Will They Dump When They Get There -- Population Distribution, Environmental Damage, and the Quality of Life,
W72-05123 6B

QUANTIFICATION
Information Requirement for Socio-Ecological Models,
W72-05119 6A

QUANTITATIVE SAMPLER
A Quantitative Sampler for Aquatic Phytomacrofauna,
W72-04710 5A

RACCOON MOUNTAIN PLANT
Reversible Pump/Turbines for Raccoon Mountain,
W72-04874 8C

RADAR
Evaluation of Radar and Raingage Systems for Flood Forecasting,
W72-04966 2B

RADIATION
Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

RADIATION SENSOR
Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

RADIOCHEMICAL ANALYSIS
Determination of Tritium in Water by the U.S. Geological Survey, Denver, Colorado,
W72-04842 5A

RAINFALL
A Truncated Square-Root-Normal Distribution Applied to Monthly Precipitation Totals for Ghent (Belgium),
W72-05048 2B

Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

RAINFALL-RUNOFF RELATIONSHIPS
Rainfall and Run-off from an Industrial Area in Nairobi, Kenya,
W72-04837 4C

Runoff from Impervious Surfaces,
W72-04844 4C

Problems Raised by the Application of Stochastic Relations to Hydrologic Variables and Means of Their Solution (Problemes souleves par l' application des relations stochastiques aux variables hydrologiques et moyens de les resoudre),
W72-04847 2A

Hymo, A Problem-Oriented Computer Language for Building Hydrologic Models,
W72-05028 7C

Effects of Random Data Errors on the Parameter Values for a Conceptual Model,
W72-05029 7A

RAINGAGES
Evaluation of Radar and Raingage Systems for Flood Forecasting,
W72-04966 2B

RATE OF ADSORPTION
Evaluation Criteria for Granular Activated Carbons,
W72-04977 5D

RATE OF ATTRITION
Evaluation Criteria for Granular Activated Carbons,
W72-04977 5D

RAYMOND BASIN (CALIF)
Estimated Subsidence in the Raymond Basin, Los Angeles County, California, for a Postulated Water-Level Lowering, 1970-2020,
W72-04823 4B

REACTION RATE
Influence of Temperature on Anaerobic Digestion,
W72-05010 5D

RECHARGE
Catalog of Recharge Basins on Long Island, N.Y., In 1969,
W72-04833 4A

Groundwater Law, Management and Administration,
W72-05101 6E

Water Conservation by Reclamation and Recharge,
W72-05140 5D

RECIRCULATED WATER
Advances in the Continuous Culture of Planktonic Copepods,
W72-04900 5A

The Reuse of Water in Manufacturing: An Explanatory Economic Model with Data Analysis,
W72-05093 3E

RECIRCULATION
Toxic Effects of Ammonia Nitrogen in High-Rate Digestion,
W72-05015 5D

RECREATION
The Role of Recreation and Environmental Quality in Water Management,
W72-04894 6B

Public Access Rights in Waters and Shorelands,
W72-05100 6E

RECREATION FACILITIES
Water Quality Office.
W72-04791 5C

RED RIVER
Bacterial Counts of a Section of the Red River -- Summer, 1970,
W72-05056 5A

RED TROUT
Study on the New Strain of the Pathogenic 'Vibrio' Isolated from Freshwater Fishes,
W72-04720 5A

REDUCING EVAPOTRANSPIRATION
Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

REFRIGERATION
A New Concept in Sample Preservation--Poisoning and Depoisoning,
W72-05012 5A

REGIONAL FLOOD
Floods on Yahara River, Lake Kegonsa Dam to County Line, Dane County, Wisconsin,
W72-04815 4A

REGRESSION ANALYSIS
Problems Raised by the Application of Stochastic Relations to Hydrologic Variables and Means of Their Solution (Problemes souleves par l' application des relations stochastiques aux variables hydrologiques et moyens de les resoudre),
W72-04847 2A

A Method for Predicting Peak Flows From Small Rural Vermont Watersheds,
W72-04897 8B

Analytical Parameters of Petrochemical and Refinery Wastewaters,
W72-05014 5D

REMOTE SENSING
Pollution Detection by Remote Sensing.
W72-04726 5A

Earth Resource Technology Used in Pollution Detection,
W72-04742 5A

Thermal Mapping of Selected Sites in the Lake Kinneret Region,
W72-04811 7B

Thermal Study of the Missouri River in North Dakota Using Infrared Imagery,
W72-04824 5B

REPUBLIC OF COLUMBIA
Analysis of Colombian Precipitation to Estimate Irrigation Requirements,
W72-04806 2B

RESERVOIR CONSTRUCTION
Seasonal Meteorological Conditions in the Region of the Bratsk Reservoir (Sezonnyye meteorologicheskiye usloviya v rayone Bratskogo vodokhranilishcha),
W72-04854 2H

RESERVOIR STAGES
Natural Conditions and Aquatic Life of the Bratsk Reservoir (Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha).
W72-04853 2H

Seasonal Meteorological Conditions in the Region of the Bratsk Reservoir (Sezonnyye meteorologicheskiye usloviya v rayone Bratskogo vodokhranilishcha),
W72-04854 2H

Formation of Phytoplankton in the Bratsk Reservoir (Formirovaniye fitoplanktona Bratskogo vodokhranilishcha),
W72-04855 5C

Aquatic Bacteria in the Bratsk Reservoir in 1965 (Bakterioplankton Bratskogo vodokhranilishcha v 1965 g.),
W72-04856 2H

Formation of Zooplankton in the Bratsk Reservoir During the First Two Years of Impoundment, 1962-63 (Formirovaniye zooplanktona v pervyye dva goda zapolneniya Bratskogo vodokhranilishcha (1962-1963 gg.)),
W72-04857 2H

Fish Population and Distribution in the Oka River Section of the Bratsk Reservoir (Razmeshcheniye i chislennost' ryb v Okinskoy chasti Bratskogo vodokhranilishcha),
W72-04858 2H

Long-Term Water-Quality Characteristics of the Bratsk Reservoir and Forecast of Organic Matter Accumulation (Mnogoletnyaya kharakteristika formirovaniya kachestva vody i prognoz nakopleniya organicheskogo veshchestva v Bratskom vodok hranilishche),
W72-04859 5C

Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

RESERVOIR STORAGE
Hydrology of Hungry Horse Reservoir, Northwestern Montana,
W72-04821 4A

RESERVOIR YIELD
Hydrology of Hungry Horse Reservoir, Northwestern Montana,
W72-04821 4A

RESERVOIRS
Eutrophication of Small Reservoirs in the Great Plains,
W72-04759 5C

Eutrophication of Small Reservoirs in the Great Plains,
W72-04761 5C

Hydrology of Hungry Horse Reservoir, Northwestern Montana,
W72-04821 4A

Seasonal Meteorological Conditions in the Region of the Bratsk Reservoir (Sezonnyye meteorologicheskiye usloviya v rayone Bratskogo vodokhranilishcha),
W72-04854 2H

Formation of Phytoplankton in the Bratsk Reservoir (Formirovaniye fitoplanktona Bratskogo vodokhranilishcha),
W72-04855 5C

Aquatic Bacteria in the Bratsk Reservoir in 1965 (Bakterioplankton Bratskogo vodokhranilishcha v 1965 g.),
W72-04856 2H

Formation of Zooplankton in the Bratsk Reservoir During the First Two Years of Impoundment, 1962-63 (Formirovaniye zooplanktona v pervyye dva goda zapolneniya Bratskogo vodokhranilishcha (1962-1963 gg.)),
W72-04857 2H

Fish Population and Distribution in the Oka River Section of the Bratsk Reservoir (Razmeshcheniye i chislennost' ryb v Okinskoy chasti Bratskogo vodokhranilishcha),
W72-04858 2H

Long-Term Water-Quality Characteristics of the Bratsk Reservoir and Forecast of Organic Matter Accumulation (Mnogoletnyaya kharakteristika formirovaniya kachestva vody i prognoz nakopleniya organicheskogo veshchestva v Bratskom vodok hranilishche),
W72-04859 5C

RESOURCE ALLOCATION
Alternative Water Policies for an Arid Region,
W72-04892 6B

Ecology and Man, The Dilemma of Our Technological Culture,
W72-05084 6B

Urban Social Theory and Research,
W72-05121 6B

RESOURCE MANAGEMENT
Public Participation and Environmental Quality,
W72-04839 6A

RESOURCES
The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

RESOURCES MISMANAGEMENT
Ecology and Man, The Dilemma of Our Technological Culture,
W72-05084 6B

RESOURCES RENEWAL
Ecology and Man, The Dilemma of Our Technological Culture,
W72-05084 6B

RESOURCES USE
The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

REVERSIBLE TURBINES
Single-Stage, 500 M High-Head Reversible Pump-Turbines and Generator-Motors for Numappara Power Station,
W72-04867 8C

Field Test Results on Diagonal-Flow Type Reversible Pump-Turbines and Generator-Motors for Takane No. 1 Power Station,
W72-04868 8C

Reversible Pump/Turbines for Raccoon Mountain,
W72-04874 8C

REVIEWS
Qanat Systems in Iran,
W72-04849 4B

A Review of Inter-Regional and International Water Transfer Proposals,
W72-04883 6B

Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

Artificial Recharge of Aquifers (Alimentation Artificielle des Nappes),
W72-05044 4B

RICE
A Physical Analysis of Diurnal Temperature Regimes in Clear and Turbid Water Layers: A Problem in Rice Culture,
W72-05144 2D

RIPARIAN LAND
Public Access Rights in Waters and Shorelands,
W72-05100 6E

RIPARIAN LAW
Riparian Water Law. A Functional Analysis,
W72-05097 6E

RIVER BASINS
A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

RIVER FORECASTING
Evaluation of Radar and Raingage Systems for Flood Forecasting,
W72-04966 2B

ROTARY SCREENING
Demonstration of Rotary Screening for Combined Sewer Overflows.
W72-04827 5D

ROUTING
A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

Hymo, A Problem-Oriented Computer Language for Building Hydrologic Models,
W72-05028 7C

RUNOFF
A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

SALINE WATER
Salty Ground Water and Meteoric Flushing of Contaminated Aquifers in West Virginia,
W72-04801 5B

Specific Conductance Model for Natural Waters and Soil Solutions of Limited Salinity Levels,
W72-05053 2G

SALINE WATER INTRUSION
Salty Ground Water and Meteoric Flushing of Contaminated Aquifers in West Virginia,
W72-04801 5B

SALT VALLEY RESERVOIRS (NEB)
Eutrophication of Small Reservoirs in the Great Plains,
W72-04761 5C

SAMPLE PRESERVATION
Method For the Storage of Samples For Dissolved Gas Analyses,
W72-04729 5A

Levels of Inorganic and Total Phosphorus in Lake Sediments as Related to Other Sediment Parameters,
W72-04732 5C

Methods for Chemical Analysis of Water and Wastes, 1971.
W72-04735 5A

SAMPLING
A Quantitative Sampler for Aquatic Phytomacrofauna,
W72-04710 5A

A Quantitative Plankton Sampler,
W72-04713 7B

A Simplified Tube Bottom Sampler,
W72-04715 7B

Method For the Storage of Samples For Dissolved Gas Analyses,
W72-04729 5A

Space-Time Sampling of Ecological Systems,
W72-04779 6A

A Geochemical Drainage Survey and Its Implications for Metallogenesis, Central Coast Mountains, British Columbia,
W72-04798 2K

A New Concept in Sample Preservation--Poisoning and Depoisoning,
W72-05012 5A

Wire-Guided Self-Propelled Water Sampler.
W72-05042 7B

SAN FRANCISCO BAY
An Intersectoral Programming Model for the Management of the Waste Water Economy of the San Francisco Bay Region,
W72-04780 5B

SAN JOAQUIN VALLEY (CALIF)
Descriptions and Chemical Analyses for Selected Wells in the Dos Palos-Kettleman City area, San Joaquin Valley, California,
W72-04843 2K

SAN LUIS VALLEY (COLO)
Hydrologic Data for the San Luis Valley, Colorado,
W72-05025 7C

SANTA CLARA VALLEY (CALIF)
Water Chemistry of the Santa Clara Valley, California,
W72-04835 2K

SATURATED FLOW
Seepage Through Saturated and Unsaturated Layers,
W72-05045 2G

SAWMILL
Toughest Air/Water Rules Met by New Kraft Mill at Halsey, Oregon,
W72-04993 5D

SCREENS
Demonstration of Rotary Screening for Combined Sewer Overflows.
W72-04827 5D

Microstraining of Combined Sewer Overflows,
W72-04971 5D

SEA OF GALILEE AREA
Thermal Mapping of Selected Sites in the Lake Kinneret Region,
W72-04811 7B

SEA WATER
Removal of Trace Metals From Marine Culture Media,
W72-04708 5A

Earth Resource Technology Used in Pollution Detection,
W72-04742 5A

Effect of Upwelling, Mixing, and High Primary Productivity on CO2 Concentrations in Surface Waters of the Bering Sea,
W72-05038 2K

SEDIMENT LOAD
A Note on Inexpensive Telemetry of River Sediment Concentrations,
W72-05049 7B

SEDIMENT TRANSPORT
Coastal Sedimentation of Southeastern Lake Michigan, Field Trip Guidebook,
W72-04807 2J

Wind Stress Criteria in Eolian Sand Transport,
W72-05037 2J

SEDIMENTATION
Coastal Sedimentation of Southeastern Lake Michigan, Field Trip Guidebook,
W72-04807 2J

Recent Experiences in Plant-Scale Application of the Settling Tube Concept,
W72-04991 5D

Effects of Siltation and Coarser Sediments on Distribution and Abundance of Stream-Inhabiting Insects,
W72-05024 5C

SEDIMENTATION EFFECTS
Effects of Siltation and Coarser Sediments on Distribution and Abundance of Stream-Inhabiting Insects,
W72-05024 5C

SEDIMENTOLOGY
Election Micrographs of Lake Kinneret Sediments,
W72-04810 2J

SEDIMENTS
Vertical Distribution of Some Ciliated Protozoa in Two Freshwater Sediments,
W72-04718 5C

DDT in Forest Streams,
W72-04719 5B

Levels of Inorganic and Total Phosphorus in Lake Sediments as Related to Other Sediment Parameters,
W72-04732 5C

Selenium in Lake Sediments - Analytical Procedure and Preliminary Results,
W72-04733 5A

Phosphate Equilibria on Stream Sediment and Soil in a Watershed Draining an Agricultural Region,
W72-04774 5C

A Geochemical Drainage Survey and Its Implications for Metallogenesis, Central Coast Mountains, British Columbia,
W72-04798 2K

Election Micrographs of Lake Kinneret Sediments,
W72-04810 2J

Geochemical Mass Balance Among Lithosphere, Hydrosphere, and Atmosphere,
W72-04814 2K

SEEPAGE
Seepage Through Saturated and Unsaturated Layers,
W72-05045 2G

SELENIUM
Selenium in Lake Sediments - Analytical Procedure and Preliminary Results,
W72-04733 5A

Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

SENSITIVITY
Trace Element Analysis of Environmental Samples by Neutron Activation Method,
W72-04998 5A

SEPARATION TECHNIQUES
Microstraining of Combined Sewer Overflows,
W72-04971 5D

Phosphorus Removal by Luxury Uptake,
W72-05011 5D

SEPTIC TANKS
Methods of Geologic Evaluation of Pollution Potential at Mountain Homesites,
W72-04803 5B

SETTLING TUBES
Recent Experiences in Plant-Scale Application of the Settling Tube Concept,
W72-04991 5D

SEWAGE EFFLUENT
Multiple Water Reuse,
W72-04994 5D

SEWAGE STORAGE
Auxiliary Sewage Storage System for Temporarily Storing Sewage,
W72-05022 5D

SEWAGE TREATMENT
Coliform Aerosols Emitted by Sewage Treatment Plants,
W72-04711 5D

Multiple Water Reuse,
W72-04994 5D

Auxiliary Sewage Storage System for Temporarily Storing Sewage,
W72-05022 5D

SHEAR
Wind Stress Criteria in Eolian Sand Transport,
W72-05037 2J

SHORT CIRCUITS
The Response of Substation Bus Systems to Short Circuit Conditions: Part I, II, III,
W72-04862 8C

SILVER
Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

SILVER IODIDE
Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

SIMULATED RAINFALL
Evaluation of Radar and Raingage Systems for Flood Forecasting,
W72-04966 2B

SIMULATION ANALYSIS
Effects of Random Data Errors on the Parameter Values for a Conceptual Model,
W72-05029 7A

Algebraic Technological Function from a Simulation Model,
W72-05034 6A

SIMULTANEOUS EQUATIONS MODEL
The Reuse of Water in Manufacturing: An Explanatory Economic Model with Data Analysis,
W72-05093 3E

SITING SURVEYS
Guidelines: Biological Surveys at Proposed Heat Discharge Sites,
W72-04828 5G

SLOPES
The Measurement of Small Soil Displacements on a Dutch Hillslope,
W72-05040 2G

SLUDGE
Polymers in the Filtration of Raw Sludge,
W72-04968 5D

Pumping Sludge Long Distances,
W72-05013 5D

SLUDGE BULKING
Identification of Filamentous Microorganisms in Activated Sludge,
W72-04984 5B

SLUDGE CONDITIONING
Polymers in the Filtration of Raw Sludge,
W72-04968 5D

SLUDGE DIGESTION
Operational Stability of the Extended Aeration Process,
W72-04784 5D

SLUDGE TREATMENT
Operational Stability of the Extended Aeration Process,
W72-04784 5D

SMALL WATERSHEDS
A Method for Predicting Peak Flows From Small Rural Vermont Watersheds,
W72-04897 8B

SNAKE PLAIN AQUIFER (IDAHO)
Ground-Water Pumpage from the Snake Plain Aquifer, Southeastern Idaho,
W72-04820 4B

SNOW
Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

SNOW MELT
Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

SNOW PACK
Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

SNOWFALL
Snowfall From Lake-Effect Storms,
W72-04845 2B

SNOWMELT
Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

New Landmark in the White Mountains,
W72-05080 2A

SNOWMELT RUNOFF
Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

SNOWMELT SEASON
Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

SOCIAL ASPECTS
The Social Context of Urban Planning,
W72-04758 6B

Environmental Policy in a Hypertrophic Society,
W72-04938 6B

The Environmental Movement: Ambiguities and Meanings,
W72-05021 6B

Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

Environmental Policy and the Congress,
W72-05118 6E

Urban Social Theory and Research,
W72-05121 6B

Planning for People, Not Buildings,
W72-05133 6B

SOCIAL CHANGE
The Environmental Movement: Ambiguities and Meanings,
W72-05021 6B

SOCIAL CONSTRAINTS
Urban Social Theory and Research,
W72-05121 6B

SOCIAL CONTEXT
The Social Context of Urban Planning,
W72-04758 6B

SOCIAL COSTS
Information Requirement for Socio-Ecological Models,
W72-05119 6A

SOCIAL IMPACT
Water Resource Investments and National Goals,
W72-04891 6B

SOCIAL SCIENCE RESEARCH
Urban Social Theory and Research,
W72-05121 6B

SOCIAL VALUES
Environmental Policy and Politics: Value and Power Context,
W72-04985 6B

The Environmental Movement: Ambiguities and Meanings,
W72-05021 6B

SOCIO-ECOLOGICAL MODELS
Information Requirement for Socio-Ecological Models,
W72-05119 6A

SOCIOLOGY
The Social Context of Urban Planning,
W72-04758 6B

SODIUM ALUMINATE
Microstraining Paper Mill Wastewater,
W72-04996 5D

SODIUM CHLORIDE
Effects of Sodium Chloride on Outgrowth and Toxin Production of Clostridium botulinum Type E in cod Homogenates,
W72-04737 5C

SOIL CHEMISTRY
Cation Adsorption in One-Dimensional Flow Through Soils: A Numerical Solution,
W72-05031 2G

SOIL CLAYS
Cation Exchange Selectivity of Some Clay-Sized Minerals and Soil Materials,
W72-05127 2K

SOIL CREEP
The Measurement of Small Soil Displacements on a Dutch Hillslope,
W72-05040 2G

SOIL DISPOSAL FIELDS
Methods of Geologic Evaluation of Pollution Potential at Mountain Homesites,
W72-04803 5B

SOIL EROSION
The Measurement of Small Soil Displacements on a Dutch Hillslope,
W72-05040 2G

SOIL FILTRATION
Soil Filtration to Remove Odors,
W72-05073 5D

SOIL MOISTURE
Soil Moisture Content, Tilth, and Soybean Response with Surface and Subsurface Drainage,
W72-05145 2G

Concepts of Soil Moisture Availability and Their Effect on Soil Moisture Estimates from a Meteorological Budget,
W72-05149 2D

SOIL TEMPERATURE
The Formation of Nitrate from Ammonium Nitrogen in Soils: IV. Use of the Delay and Maximum Rate Phases for Making Quantitative Predictions,
W72-05120 5B

SOIL WATER
Specific Conductance Model for Natural Waters and Soil Solutions of Limited Salinity Levels,
W72-05053 2G

In Situ Measurement of Soil and Plant Leaf Water Potential,
W72-05136 2D

SOIL-WATER-PLANT RELATIONSHIPS
Water Stress Gradients in Plants and Soil-Root Systems,
W72-05139 2G

SOIL WATER POTENTIAL
In Situ Measurement of Soil and Plant Leaf Water Potential,
W72-05136 2D

SOLAR RADIATION
Equilibrium Temperatures of Water Surfaces as Related to Air Temperature and Solar Radiation,
W72-05026 2B

Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

A Physical Analysis of Diurnal Temperature Regimes in Clear and Turbid Water Layers: A Problem in Rice Culture,
W72-05144 2D

SOLAR RADIATION EQUATIONS
Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

SOLID WASTES
Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

SOLIDS DISPOSAL
Discussion of 'Toxic Effects of Ammonia Nitrogen in High Rate Digestion',
W72-05016 5D

SOLUBILITY
Solubility of Barium and Strontium Sulfates in Strong Electrolyte Solutions,
W72-04793 5G

SOUTH DAKOTA
Soil-Desiccation Features in South Dakota Depressions,
W72-04812 2G

SOUTH TEXAS
Relation of Ponded Floodwater from Hurricane Beulah to Ground Water in Kleberg, Kenedy, and Willacy Counties, Texas,
W72-04796 2F

SPACERS
The Vibrations of Transmission Line Conductor Bundles,
W72-04863 8C

SPATIAL CONSTRAINTS
Urban Social Theory and Research,
W72-05121 6B

SPATIAL VARIATION
Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

SPECIFIC CONDUCTANCE
Specific Conductance Model for Natural Waters and Soil Solutions of Limited Salinity Levels,
W72-05053 2G

SPECTROMETERS
ESCA--The New Spectroscopy,
W72-05051 2K

SPECTROPHOTOMETRY
Methods for Chemical Analysis of Water and Wastes, 1971.
W72-04735 5A

Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides,
W72-04738 5A

SPECTROSCOPY
Characterization of Four Major Components in a Technical Polychlorinated Biphenyl Mixture,
W72-04730 5A

Methods for Chemical Analysis of Water and Wastes, 1971.
W72-04735 5A

ESCA--The New Spectroscopy,
W72-05051 2K

SPHEROIDAL WEATHERING
Causes of Spheroidal Weathering,
W72-04794 2J

SPILLS
Industrial Spill Control and Pollution Incident Prevention,
W72-05017 5G

SPILLWAY CRESTS
Flow Over Rounded Spillways,
W72-04809 8B

SPILLWAYS
Flow Over Rounded Spillways,
W72-04809 8B

SPORES
Detection of Clostridium Botulinum Type E in Smoked Fish,
W72-04745 5A

SPRINGS
Groundwater Discharge: A Common Generator of Diverse Geologic and Morphologic Phenomena,
W72-04851 2F

SPRINKLER IRRIGATION
Disposal of Insulation Board Mill Effluent by Land Irrigation,
W72-05002 5D

SPROUT GROWTH FROM STUMPS
Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

STANDARDS
The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

STATE GOVERNMENTS
A New Dimension of State Planning -- Policy Development and Issue Analysis,
W72-05052 6E

STATE PLANNING SYSTEMS
A New Dimension of State Planning -- Policy Development and Issue Analysis,
W72-05052 6E

STATIONS
Peaking-Station Layouts on Himalayan Rivers,
W72-04875 4A

STATISTICAL GEOMETRY
Statistical Geometry of Porous Media,
W72-04783 2G

STATISTICAL METHODS
Levels of Inorganic and Total Phosphorus in Lake Sediments as Related to Other Sediment Parameters,
W72-04732 5C

A Flood-Frequency Relation Based on Regional Record Maxima,
W72-04797 2E

Detection of a Change in Runoff by an Analysis of Daily Flows,
W-72 04846 2A

STATISTICAL MODELS
Statistical Geometry of Porous Media,
W72-04783 2G

Stochastic Modeling of Temperature and Flow in Rivers,
W72-05030 2A

STATISTICS
A Truncated Square-Root-Normal Distribution Applied to Monthly Precipitation Totals for Ghent (Belgium),
W72-05048 2B

STEADY STATE
Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

STOCHASTIC MODELS
Stochastic Modeling of Temperature and Flow in Rivers,
W72-05030 2A

STOCHASTIC PROCESSES
Problems Raised by the Application of Stochastic Relations to Hydrologic Variables and Means of Their Solution (Problemes souleves par l' application des relations stochastiques aux variables hydrologiques et moyens de les resoudre),
W72-04847 2A

Stochastic Modeling of Temperature and Flow in Rivers,
W72-05030 2A

STORM DRAINS
Microstraining of Combined Sewer Overflows,
W72-04971 5D

STORM RUNOFF
Demonstration of Rotary Screening for Combined Sewer Overflows.
W72-04827 5D

Catalog of Recharge Basins on Long Island, N.Y., In 1969,
W72-04833 4A

Rainfall and Run-off from an Industrial Area in Nairobi, Kenya,
W72-04837 4C

Microstraining of Combined Sewer Overflows,
W72-04971 5D

Effects of Urbanization on Storm Water Runoff Quality: A Limited Experiment, Naismith Ditch, Lawrence, Kansas,
W72-05035 4C

STORMS
Snowfall From Lake-Effect Storms,
W72-04845 2B

STRATIGRAPHY
Farmdalian Lake Deposits and Faunas in Northern Illinois,
W72-04834 2H

STREAM ORDER
Application of Stream Order Numbers to the Merrimack River Basin,
W72-05036 4A

STREAMFLOW
Results of a Field Study Using the 3-Axis Doppler Shift Current Meter,
W72-04817 2L

A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

New Landmark in the White Mountains,
W72-05080 2A

STREAMFLOW DISTRIBUTION
New Landmark in the White Mountains,
W72-05080 2A

STREAMFLOW FORECASTING
Detection of a Change in Runoff by an Analysis of Daily Flows,
W-72 04846 2A

Stochastic Modeling of Temperature and Flow in Rivers,
W72-05030 2A

STREAMFLOW YIELD
Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

STREAMS
Life Histories and Drifting of Three Species of Limnephilidae (Trichoptera),
W72-04714 5A

Effects of Siltation and Coarser Sediments on Distribution and Abundance of Stream-Inhabiting Insects,
W72-05024 5C

STREET RUNOFF
Runoff from Impervious Surfaces,
W72-04844 4C

STRESS ANALYSIS
Structural Measurements With Holographic Interferometry,
W72-04865 8A

STRUCTURAL ANALYSIS
Structural Measurements With Holographic Interferometry,
W72-04865 8A

SUBLITTORAL BENTHIC MACROPHYTES
The Distribution and Net Productivity of Sublittoral Populations of Attached Macrophytic Algae in an Estuary on the Atlantic Coast of Spain,
W72-04766 5C

SUBMERGED LANDS ACT
Public Access Rights in Waters and Shorelands,
W72-05100 6E

SUBSTATIONS (ELECTRICAL)
The Response of Substation Bus Systems to Short Circuit Conditions: Part I, II, III,
W72-04862 8C

SUBSTRATES
Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

SUBSURFACE DRAINAGE
Soil Moisture Content, Tilth, and Soybean Response with Surface and Subsurface Drainage,
W72-05145 2G

SULFATES
Solubility of Barium and Strontium Sulfates in Strong Electrolyte Solutions,
W72-04793 5G

SURFACE DRAINAGE
Soil Moisture Content, Tilth, and Soybean Response with Surface and Subsurface Drainage,
W72-05145 2G

SURFACE-GROUNDWATER RELATIONSHIPS
Relation of Ponded Floodwater from Hurricane Beulah to Ground Water in Kleberg, Kenedy, and Willacy Counties, Texas,
W72-04796 2F

Groundwater Discharge: A Common Generator of Diverse Geologic and Morphologic Phenomena,
W72-04851 2F

Streamflow, Groundwater and Ground Response Data--Volume II, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05096 7C

SURFACE RUNOFF
Chlorinated Hydrocarbon Pesticides in Iowa Rivers,
W72-04753 5B

A Comparison of Nitrogen Losses From Urea and Ammonium Nitrate in Surface Runoff Water,
W72-05142 5B

SURFACE WATERS
Hydrologic Data for Horseshoe Lake, Arkansas, and Vicinity,
W72-04822 7C

Records of Wells, Springs, and Test Borings, Chemical Analyses of Water, Sediment Analyses, Standard Streamflow Data Summaries, and Selected Drillers' Logs From The Little Kanawha River Basin in West Virginia,
W72-04841 7C

Effect of Upwelling, Mixing, and High Primary Productivity on CO2 Concentrations in Surface Waters of the Bering Sea,
W72-05038 2K

Water Resources Data for Wisconsin, 1969: Part 1. Surface Water Records, and Part 2. Water Quality Records.
W72-05094 7C

SURVEYS
Coastal Sedimentation of Southeastern Lake Michigan, Field Trip Guidebook,
W72-04807 2J

SURVIVAL
Survival of Coliform Bacteria in Wastewater Treatment Lagoons,
W72-04976 5D

SUSPENDED LOAD
A Note on Inexpensive Telemetry of River Sediment Concentrations,
W72-05049 7B

SUSPENDED SOLIDS
Demonstration of Rotary Screening for Combined Sewer Overflows.
W72-04827 5D

Design and Operation of an Extended Aeration Plant,
W72-04973 5D

Operation of Conventional Activated Sludge for Maximum Phosphorus Removal,
W72-04978 5D

Abatement of Pollution From a Poultry Processing Plant,
W72-05006 5D

SWAMPS
Groundwater Discharge: A Common Generator of Diverse Geologic and Morphologic Phenomena,
W72-04851 2F

SYMBIOSIS
Algal-Bacterial Symbiosis for Removal and Conservation of Wastewater Nutrients,
W72-04983 5D

SYNTHESIS
Characterization of Four Major Components in a Technical Polychlorinated Biphenyl Mixture,
W72-04730 5A

SYNTHETIC HYDROLOGY
Effects of Random Data Errors on the Parameter Values for a Conceptual Model,
W72-05029 7A

SYSTEMATICS
Identification of Filamentous Microorganisms in Activated Sludge,
W72-04984 5B

SYSTEMS ANALYSIS
Algebraic Technological Function from a Simulation Model,
W72-05034 6A

Cooperation of Government, Science, and Industry in Research and Development - A Systems View,
W72-05075 6B

A Computerized Educational Program for the Application of the Management Sciences to Water Resource Management,
W72-05088 7C

TDE
Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

TECHNOLOGY
Ecology and Technology in Twentieth-Century Landscapes,
W72-04980 6B

Ecology and Man, The Dilemma of Our Technological Culture,
W72-05084 6B

TELEMETRY
A Note on Inexpensive Telemetry of River Sediment Concentrations,
W72-05049 7B

TELEOST PATHOLOGY
Histological and Hematological Responses of an Estuarine Teleost to Cadmium,
W72-04709 5C

TEMPERATURE
Influence of Temperature on Anaerobic Digestion,
W72-05010 5D

TENSIOMETERS
In Situ Measurement of Soil and Plant Leaf Water Potential,
W72-05136 2D

TERTIARY TREATMENT
Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

Process Evaluation--Phosphorus Removal,
W72-04979 5D

TEXAS
Records of Wells, Drillers' Logs, and Chemical Analysis of Ground Water in Galveston County, Texas 1952-1970,
W72-04795 4B

Relation of Ponded Floodwater from Hurricane Beulah to Ground Water in Kleberg, Kenedy, and Willacy Counties, Texas,
W72-04796 2F

TEXTILE WASTES
The Economic Feasibility of Treating Textile Wastes in Municipal Systems,
W72-04989 5D

THEORETICAL DEPTH
The Social Context of Urban Planning,
W72-04758 6B

THEORY
Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

THERMAL POLLUTION
Thermal Study of the Missouri River in North Dakota Using Infrared Imagery,
W72-04824 5B

Guidelines: Biological Surveys at Proposed Heat Discharge Sites,
W72-04828 5G

A Survey of Alternate Methods for Cooling Condenser Discharge Water, Total Community Considerations in the Utilization of Rejected Heat,
W72-04830 5D

An Engineering-Economic Study of Cooling Pond Performance.
W72-04831 5D

Nuclear Energy for a New Town,
W72-05091 6G

THERMAL POWER
A Survey of Alternate Methods for Cooling Condenser Discharge Water, Total Community Considerations in the Utilization of Rejected Heat,
W72-04830 5D

THERMAL POWER PLANT
Research on Dry-Type Cooling Towers for Thermal Electric Generation: Part I,
W72-04829 5D

THERMAL RADIATION
Thermal Mapping of Selected Sites in the Lake Kinneret Region,
W72-04811 7B

THERMOCLINE
A Quantitative Plankton Sampler,
W72-04713 7B

THERMOMETERS
An Active Method for Correcting the Frequency Response of the Temperature Sensors of Oceanological Instruments,
W72-04749 7B

TIDAL EFFECTS
Groundwater Flow in a Sandy Tidal Beach: Two-Dimensional Finite Element Analysis,
W72-05033 2F

TIDAL WATERS
Results of a Field Study Using the 3-Axis Doppler Shift Current Meter,
W72-04817 2L

Volumetric, Areal, and Tidal Statistics of The Chesapeake Bay Estuary and Its Tributaries,
W72-04838 2L

TIME SERIES ANALYSIS
Development of a Procedure for Determining Spacial and Time Variations of Precipitation in Venezuela,
W72-04804 2B

Detection of a Change in Runoff by an Analysis of Daily Flows,
W-72 04846 2A

Stochastic Modeling of Temperature and Flow in Rivers,
W72-05030 2A

TOTAL ORGANIC CARBON
Analytical Parameters of Petrochemical and Refinery Wastewaters,
W72-05014 5D

TOTAL ORGANIC CARBON ANALYZER
The Total Organic Carbon Analyzer and Its Application to Water Research,
W72-05001 5A

TOXICITY
Metals Focus Shifts to Cadmium.
W72-04727 5B

Characterization of Four Major Components in a Technical Polychlorinated Biphenyl Mixture,
W72-04730 5A

Detection of Clostridium Botulinum Type E in Smoked Fish,
W72-04745 5A

Biological Treatment of Chlorophenolic Wastes.
W72-04825 5D

Toxic Effects of Ammonia Nitrogen in High-Rate Digestion,
W72-05015 5D

TOXIN PRODUCTION
Effects of Sodium Chloride on Outgrowth and Toxin Production of Clostridium botulinum Type E in cod Homogenates,
W72-04737 5C

TRACE ELEMENTS
Removal of Trace Metals From Marine Culture Media,
W72-04708 5A

Selenium in Lake Sediments - Analytical Procedure and Preliminary Results,
W72-04733 5A

Trace Elements and Compounds in Waters,
W72-04969 5F

Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

Trace Element Analysis of Environmental Samples by Neutron Activation Method,
W72-04998 5A

TRANSMISSION CAPACITY
Incremental Voltage Uprating of Transmission Lines,
W72-04864 8C

TRANSMISSION (ELECTRICAL)
Incremental Voltage Uprating of Transmission Lines,
W72-04864 8C

TRANSMISSION LINES
The Vibrations of Transmission Line Conductor Bundles,
W72-04863 8C

Incremental Voltage Uprating of Transmission Lines,
W72-04864 8C

TRANSPIRATION
Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

New Landmark in the White Mountains,
W72-05080 2A

In Situ Measurement of Soil and Plant Leaf Water Potential,
W72-05136 2D

Plant Growth-Evapotranspiration Relations for Several Crops in the Central Great Plains,
W72-05147 2D

TREATMENT
Handling Livestock Waste,
W72-05057 5D

TREATMENT FACILITIES
Design and Operation of an Extended Aeration Plant,
W72-04973 5D

Toughest Air/Water Rules Met by New Kraft Mill at Halsey, Oregon,
W72-04993 5D

Auxiliary Sewage Storage System for Temporarily Storing Sewage,
W72-05022 5D

TRICKLING FILTERS
Recent Experiences in Plant-Scale Application of the Settling Tube Concept,
W72-04991 5D

TRITIUM
Determination of Tritium in Water by the U.S. Geological Survey, Denver, Colorado,
W72-04842 5A

TROPICAL REGIONS
Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

Streamflow, Groundwater and Ground Response Data--Volume II, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05096 7C

TUNNELS
Qanat Systems in Iran,
W72-04849 4B

TURBID RESERVOIRS
Eutrophication of Small Reservoirs in the Great Plains,
W72-04761 5C

TURBIDITY
Microstraining Paper Mill Wastewater,
W72-04996 5D

A Note on Inexpensive Telemetry of River Sediment Concentrations,
W72-05049 7B

A Physical Analysis of Diurnal Temperature Regimes in Clear and Turbid Water Layers: A Problem in Rice Culture,
W72-05144 2D

TURBULENT FLOW
Analysis of Turbulent Pipe Flow,
W72-05050 8B

TURBULENT PIPE FLOW
Analysis of Turbulent Pipe Flow,
W72-05050 8B

TURKMEN SSR
Water Balance and Regionalization of Drainage in the Turkmen SSR (Vodnyy balans i rayonirovaniye drenazha v Turkmenskoy SSR),
W72-04861 4A

ULTRAVIOLET RADIATION
Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides,
W72-04738 5A

ULTRAVIOLET SPECTRA
Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides,
W72-04738 5A

UNDERGROUND POWERPLANTS
Reversible Pump/Turbines for Raccoon Mountain,
W72-04874 8C

UNSATURATED FLOW
Seepage Through Saturated and Unsaturated Layers,
W72-05045 2G

Numerical Modeling of Unsaturated Groundwater Flow Including Effects of Evapotranspiration,
W72-05089 2G

URBAN HYDROLOGY
Rainfall and Run-off from an Industrial Area in Nairobi, Kenya,
W72-04837 4C

Runoff from Impervious Surfaces,
W72-04844 4C

Effects of Urbanization on Storm Water Runoff Quality: A Limited Experiment, Naismith Ditch, Lawrence, Kansas,
W72-05035 4C

URBAN PLANNING
The Social Context of Urban Planning,
W72-04758 6B

Forecasting Planning,
W72-05082 6B

URBAN PROBLEMS
Urban Social Theory and Research,
W72-05121 6B

URBAN SOCIAL THEORY
Urban Social Theory and Research,
W72-05121 6B

URBAN SOCIOLOGY
The Social Context of Urban Planning,
W72-04758 6B

Urban Social Theory and Research,
W72-05121 6B

URBANIZATION
Rainfall and Run-off from an Industrial Area in Nairobi, Kenya,
W72-04837 4C

Runoff from Impervious Surfaces,
W72-04844 4C

Effects of Urbanization on Storm Water Runoff Quality: A Limited Experiment, Naismith Ditch, Lawrence, Kansas,
W72-05035 4C

UREA
A Comparison of Nitrogen Losses From Urea and Ammonium Nitrate in Surface Runoff Water,
W72-05142 5B

USSR
Hydrogeology and Hydrodynamics of Groundwater (Gidrogeologiya i gidrodinamika podzemnykh vod),
W72-04832 2F

USSR
Natural Conditions and Aquatic Life of the Bratsk Reservoir (Formirovaniye prirodnykh usloviy i zhizni Bratskogo vodokhranilishcha).
W72-04853 2H

USSR
Seasonal Meteorological Conditions in the Region of the Bratsk Reservoir (Sezonnyye meteorologicheskiye usloviya v rayone Bratskogo vodokhranilishcha),
W72-04854 2H

Formation of Phytoplankton in the Bratsk Reservoir (Formirovaniye fitoplanktona Bratskogo vodokhranilishcha),
W72-04855 5C

Aquatic Bacteria in the Bratsk Reservoir in 1965 (Bakterioplankton Bratskogo vodokhranilishcha v 1965 g.),
W72-04856 2H

Formation of Zooplankton in the Bratsk Reservoir During the First Two Years of Impoundment, 1962-63 (Formirovaniye zooplanktona v pervyye dva goda zapolneniya Bratskogo vodokhranilishcha (1962-1963 gg.)),
W72-04857 2H

Fish Population and Distribution in the Oka River Section of the Bratsk Reservoir (Razmeshcheniye i chislennost' ryb v Okinskoy chasti Bratskogo vodokhranilishcha),
W72-04858 2H

Long-Term Water-Quality Characteristics of the Bratsk Reservoir and Forecast of Organic Matter Accumulation (Mnogoletnyaya kharakteristika formirovaniya kachestva vody i prognoz nakopleniya organicheskogo veshchestva v Bratskom vodok hranilishche),
W72-04859 5C

Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

Water Balance and Regionalization of Drainage in the Turkmen SSR (Vodnyy balans i rayonirovaniye drenazha v Turkmenskoy SSR),
W72-04861 4A

UTAH
Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

VALUES
Environmental Policy and Politics: Value and Power Context,
W72-04985 6B

VALVES
Choking and Supercavitating Valves,
W72-04747 8C

VAPOR DILUTION
The Quantitative Determination of the Odor Strength of Chicken Manure,
W72-05069 5A

VELOCITY
Wind Stress Criteria in Eolian Sand Transport,
W72-05037 2J

VENEZUELA
Development of a Procedure for Determining Spacial and Time Variations of Precipitation in Venezuela,
W72-04804 2B

Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

Streamflow, Groundwater and Ground Response Data--Volume II, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05096 7C

VERMONT
A Method for Predicting Peak Flows From Small Rural Vermont Watersheds,
W72-04897 8B

VERSATILE BUDGET
Concepts of Soil Moisture Availability and Their Effect on Soil Moisture Estimates from a Meteorological Budget,
W72-05149 2D

VIBRATION
The Vibrations of Transmission Line Conductor Bundles,
W72-04863 8C

VIBRIO
Study on the New Strain of the Pathogenic 'Vibrio' Isolated from Freshwater Fishes,
W72-04720 5A

VINE CROP
Phosphorus Fertilization of Hops,
W72-05148 5B

VIRUSES
Distribution of Blue-Green Algal Viruses in Various Types of Natural Waters,
W72-04736 5B

VOLUMETRIC ANALYSIS
Methods for Chemical Analysis of Water and Wastes, 1971.
W72-04735 5A

WASATCH MOUNTAINS (UTAH)
Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

WASHINGTON
Municipal, Industrial, and Irrigation Water Use in Washington, 1970,
W72-04816 6D

WASTE ASSIMILATIVE CAPACITY
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

WASTE CHARACTERIZATION
Abatement of Pollution From a Poultry Processing Plant,
W72-05006 5D

WASTE DILUTION
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

Bacterial Counts of a Section of the Red River -- Summer, 1970,
W72-05056 5A

WASTE DISPOSAL
Disposal of Insulation Board Mill Effluent by Land Irrigation,
W72-05002 5D

Dead Bird Disposal by Rendering,
W72-05055 5E

Poultry Pollution: Research Results,
W72-05058 5E

Early Experiments at Michigan State University Involving the Use of Chicken Manure,
W72-05059 5E

Economics of Dried Poultry Waste (DPW) as a Feed Ingredient or a Fertilizer,
W72-05060 5E

Feeding Dehydrated Poultry Waste to Dairy Cows,
W72-05061 5E

The Relationship of Drying Temperature to Total Crude Protein in Dried Poultry Waste,
W72-05062 5E

Drying of Poultry Manure in a Cage-Layer House,
W72-05063 5E

Dried Poultry Waste as a Protein Source for Feedlot Cattle,
W72-05064 5E

The Metabolizeable Energy Value of Dried Poultry Waste,
W72-05065 5E

The Effects of Continually Recycling Dehydrated Poultry Wastes (DPW) on the Performance of SCWL Laying Hens -- A Preliminary Report,
W72-05066 5E

WASTE HEAT
Nuclear Energy for a New Town,
W72-05091 6G

WASTE TREATMENT
Block Drying of Chicken Manure,
W72-05054 5D

Soil Filtration to Remove Odors,
W72-05073 5D

Odor Controls by Chemical Treatment,
W72-05074 5D

WASTE WATER TREATMENT
Strategies for Control of Man-Made Eutrophication,
W72-04734 5D

Operational Stability of the Extended Aeration Process,
W72-04784 5D

Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

Biological Treatment of Chlorophenolic Wastes.
W72-04825 5D

Demonstration of Rotary Screening for Combined Sewer Overflows.
W72-04827 5D

Polymers in the Filtration of Raw Sludge,
W72-04968 5D

Use of 14C-Glucose to Study Substrate Removal by Activated Sludge,
W72-04970 5D

Microstraining of Combined Sewer Overflows,
W72-04971 5D

Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

Design and Operation of an Extended Aeration Plant,
W72-04973 5D

Evaluation Criteria for Granular Activated Carbons,
W72-04977 5D

Operation of Conventional Activated Sludge for Maximum Phosphorus Removal,
W72-04978 5D

Process Evaluation--Phosphorus Removal,
W72-04979 5D

Algal-Bacterial Symbiosis for Removal and Conservation of Wastewater Nutrients,
W72-04983 5D

The Economic Feasibility of Treating Textile Wastes in Municipal Systems,
W72-04989 5D

Dual Substrate Utilization by Activated Sludge Microflora,
W72-04990 5D

Recent Experiences in Plant-Scale Application of the Settling Tube Concept,
W72-04991 5D

Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

Microstraining Paper Mill Wastewater,
W72-04996 5D

Redesigning Existing Facilities to Increase Hydraulic and Organic Loading,
W72-05004 5D

Advanced Organics Removal by Pulsed Adsorption Beds,
W72-05005 5D

Abatement of Pollution From a Poultry Processing Plant,
W72-05006 5D

Influence of Temperature on Anaerobic Digestion,
W72-05010 5D

Phosphorus Removal by Luxury Uptake,
W72-05011 5D

Toxic Effects of Ammonia Nitrogen in High-Rate Digestion,
W72-05015 5D

Discussion of 'Toxic Effects of Ammonia Nitrogen in High Rate Digestion',
W72-05016 5D

Nitrification and Denitrification in Activated Sludge Systems,
W72-05019 5D

Auxiliary Sewage Storage System for Temporarily Storing Sewage,
W72-05022 5D

Waste Water Treatment Phosphate Removal by Iron Oxide,
W72-05041 5D

WATER ANALYSES

DDT in Forest Streams,
W72-04719 5B

WATER ANALYSIS

A Quantitative Plankton Sampler,
W72-04713 7B

Distribution of Blue-Green Algal Viruses in Various Types of Natural Waters,
W72-04736 5B

Descriptions and Chemical Analyses for Selected Wells in the Dos Palos-Kettleman City area, San Joaquin Valley, California,
W72-04843 2K

Trace Elements and Compounds in Waters,
W72-04969 5F

Wire-Guided Self-Propelled Water Sampler.
W72-05042 7B

WATER BALANCE

Water Balance and Regionalization of Drainage in the Turkmen SSR (Vodnyy balans i rayonirovaniye drenazha v Turkmenskoy SSR),
W72-04861 4A

Some Results of Hydromteorological Research Work Carried Out in The Experimental Basins of the Meteorological Service of German Democratic Republic,
W72-05046 2A

WATER CHEMISTRY

Water Chemistry of the Santa Clara Valley, California,
W72-04835 2K

Long-Term Water-Quality Characteristics of the Bratsk Reservoir and Forecast of Organic Matter Accumulation (Mnogoletnyaya kharakteristika formirovaniya kachestva vody i prognoz nakopleniya organicheskogo veshchestva v Bratskom vodok hranilishche),
W72-04859 5C

Recurrence Relations for First Order Sequential Reactions in Natural Waters,
W72-05027 5B

Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

WATER COSTS

Algebraic Technological Function from a Simulation Model,
W72-05034 6A

WATER DEMAND

Water and Western Destiny: From Conflict to Cooperation.
W72-04878 6B

Water Resources Development,
W72-04880 6B

WATER EQUIVALENT

Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

WATER HYACINTH

Nutrient Removal by Waterhyacinth,
W72-04776 5C

WATER LAW

Administrative Allocation of Water,
W72-04786 6E

Legal Aspects of Water Salvage,
W72-05098 6E

Legal Protection of Instream Water Values,
W72-05099 6E

Public Access Rights in Waters and Shorelands,
W72-05100 6E

WATER LEVEL FLUCTUATIONS

Groundwater Flow in a Sandy Tidal Beach: Two-Dimensional Finite Element Analysis,
W72-05033 2F

WATER LEVELS

Ground-Water Levels in Idaho, 1971.
W72-04819 4B

WATER MANAGEMENT (APPLIED)

Water and Western Destiny: From Conflict to Cooperation.
W72-04878 6B

The Role of Recreation and Environmental Quality in Water Management,
W72-04894 6B

A Computerized Educational Program for the Application of the Management Sciences to Water Resource Management,
W72-05088 7C

WATER MEASUREMENT

Volumetric, Areal, and Tidal Statistics of The Chesapeake Bay Estuary and Its Tributaries,
W72-04838 2L

Critical-Depth Flumes for Determining Flow in Canals and Natural Channels,
W72-04871 8B

WATER OF HYDRATION

Complexes of Halloysite with Organic Compounds,
W72-05043 2K

WATER PERMITS

Riparian Water Law. A Functional Analysis,
W72-05097 6E

Legal Aspects of Water Salvage,
W72-05098 6E

WATER POLICY

Water and Western Destiny: From Conflict to Cooperation.
W72-04878 6B

The Future of Western Water Development,
W72-04879 6B

A New Look at National Water Policy,
W72-04882 6B

Alternative Water Policies for an Arid Region,
W72-04892 6B

A National Policy for Western Water Development,
W72-04895 6B

WATER POLLUTION

Bacterial Counts of a Section of the Red River -- Summer, 1970,
W72-05056 5A

WATER POLLUTION CONTROL

Pollution Detection by Remote Sensing.
W72-04726 5A

Strategies for Control of Man-Made Eutrophication,
W72-04734 5D

Earth Resource Technology Used in Pollution Detection,
W72-04742 5A

Agricultural Pollution of the Great Lakes Basin.
W72-04762 5B

ABCs of Cultural Eutrophication and Its Control. Part I--Cultural Changes,
W72-04769 5C

Solubility of Barium and Strontium Sulfates in Strong Electrolyte Solutions,
W72-04793 5G

The Use, Abuse and Recovery of a Glacial Aquifer,
W72-04802 5B

Oil Spill Containment Systems.
W72-04826 5G

Feedlot Waste Management.
W72-04965 5E

Bibliography of Products Derived from Aquatic Organisms.
W72-05086 5D

Cost of Reclamation and Mine Drainage Abatement-Elkins Demonstration Project,
W72-05146 5G

WATER POLLUTION EFFECTS

Metals Focus Shifts to Cadmium.
W72-04727 5B

Some Observations on the Limnology of a Pond Receiving Animal Wastes,
W72-04773 5C

Water Quality Office.
W72-04791 5C

The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

Effects of Siltation and Coarser Sediments on Distribution and Abundance of Stream-Inhabiting Insects,
W72-05024 5C

WATER POLLUTION SOURCES

Metals Focus Shifts to Cadmium.
W72-04727 5B

Organochlorine Insecticide Residues in Everglades National Park and Loxahatchee National Wildlife Refuge, Florida,
W72-04799 5B

Probable Impact of NTA on Ground Water,
W72-04800 5B

Salty Ground Water and Meteoric Flushing of Contaminated Aquifers in West Virginia,
W72-04801 5B

Methods of Geologic Evaluation of Pollution Potential at Mountain Homesites,
W72-04803 5B

Thermal Study of the Missouri River in North Dakota Using Infrared Imagery,
W72-04824 5B

Effects of Urbanization on Storm Water Runoff Quality: A Limited Experiment, Naismith Ditch, Lawrence, Kansas,
W72-05035 4C

WATER QUALITY

Water Quality Office.
W72-04791 5C

The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

Water Chemistry of the Santa Clara Valley, California,
W72-04835 2K

Long-Term Water-Quality Characteristics of the Bratsk Reservoir and Forecast of Organic Matter Accumulation (Mnogoletnyaya kharakteristika formirovaniya kachestva vody i prognoz nakopleniya organicheskogo veshchestva v Bratskom vodok hranilishche),
W72-04859 5C

Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

Effects of Urbanization on Storm Water Runoff Quality: A Limited Experiment, Naismith Ditch, Lawrence, Kansas,
W72-05035 4C

Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

Water Resources Data for Wisconsin, 1969: Part 1. Surface Water Records, and Part 2. Water Quality Records.
W72-05094 7C

WATER QUALITY CONTROL

An Intersectoral Programming Model for the Management of the Waste Water Economy of the San Francisco Bay Region,
W72-04780 5B

Alternatives in Water Management,
W72-04893 6B

Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

Operation of Conventional Activated Sludge for Maximum Phosphorus Removal,
W72-04978 5D

Handling Livestock Waste,
W72-05057 5D

WATER RECLAMATION

Water Conservation by Reclamation and Recharge,
W72-05140 5D

WATER REQUIREMENTS

Partial Solutions--The Outlook,
W72-04890 6B

Alternatives in Water Management,
W72-04893 6B

WATER RESOURCES

Determination of Tritium in Water by the U.S. Geological Survey, Denver, Colorado,
W72-04842 5A

WATER RESOURCES DEVELOPMENT

The Use, Abuse and Recovery of a Glacial Aquifer,
W72-04802 5B

Qanat Systems in Iran,
W72-04849 4B

The Future of Western Water Development,
W72-04879 6B

Water Resources Development,
W72-04880 6B

Making Water Resources Planning Relevant,
W72-04881 6B

A New Look at National Water Policy,
W72-04882 6B

A Look Ahead in Planning Coordination and Policy Making,
W72-04884 6B

Water Resources Planning,
W72-04885 6B

The Third Western Interstate Water Conference of Colorado State University,
W72-04886 6B

The Primacy of our Environment over the Economy,
W72-04887 6B

Improving the Planning Process--Establishing Values,
W72-04888 6B

Some Social Issues and Alternatives Involved in Planning Water Resources with People in the West,
W72-04889 6B

Water Resource Investments and National Goals,
W72-04891 6B

A National Policy for Western Water Development,
W72-04895 6B

Hydrologic Data for the San Luis Valley, Colorado,
W72-05025 7C

WATER REUSE

A Survey of Alternate Methods for Cooling Condenser Discharge Water, Total Community Considerations in the Utilization of Rejected Heat,
W72-04830 5D

Hydrogen Isotope Ratios in a Recycling System,
W72-04967 5D

Multiple Water Reuse,
W72-04994 5D

The Reuse of Water in Manufacturing: An Explanatory Economic Model with Data Analysis,
W72-05093 3E

Water Conservation by Reclamation and Recharge,
W72-05140 5D

WATER REUSE MODEL

The Reuse of Water in Manufacturing: An Explanatory Economic Model with Data Analysis,
W72-05093 3E

WATER RIGHTS

Administrative Allocation of Water,
W72-04786 6E

Legal Aspects of Water Salvage,
W72-05098 6E

Legal Protection of Instream Water Values,
W72-05099 6E

Public Access Rights in Waters and Shorelands,
W72-05100 6E

WATER SAMPLER

Wire-Guided Self-Propelled Water Sampler.
W72-05042 7B

WATER STORAGE

Catalog of Recharge Basins on Long Island, N.Y., In 1969,
W72-04833 4A

WATER SUPPLY

Municipal, Industrial, and Irrigation Water Use in Washington, 1970,
W72-04816 6D

WATER SUPPLY

Water Resources Development,
W72-04880 6B

Partial Solutions--The Outlook,
W72-04890 6B

WATER TEMPERATURE
An Active Method for Correcting the Frequency Response of the Temperature Sensors of Oceanological Instruments,
W72-04749 7B

Thermal Mapping of Selected Sites in the Lake Kinneret Region,
W72-04811 7B

Equilibrium Temperatures of Water Surfaces as Related to Air Temperature and Solar Radiation,
W72-05026 2B

Stochastic Modeling of Temperature and Flow in Rivers,
W72-05030 2A

A Physical Analysis of Diurnal Temperature Regimes in Clear and Turbid Water Layers: A Problem in Rice Culture,
W72-05144 2D

WATER TRANSFER
Water Resources Development,
W72-04880 6B

A Review of Inter-Regional and International Water Transfer Proposals,
W72-04883 6B

WATER TREATMENT
Amoebic Cysticidal Properties of Halogens in Water,
W72-04746 5F

Trace Elements and Compounds in Waters,
W72-04969 5F

WATER USERS
Municipal, Industrial, and Irrigation Water Use in Washington, 1970,
W72-04816 6D

WATER UTILIZATION
Water and Western Destiny: From Conflict to Cooperation.
W72-04878 6B

WATER VALUES
The Third Western Interstate Water Conference of Colorado State University,
W72-04886 6B

WATER WASTE
Legal Aspects of Water Salvage,
W72-05098 6E

WATER WELLS
Records of Wells, Drillers' Logs, and Chemical Analysis of Ground Water in Galveston County, Texas 1952-1970,
W72-04795 4B

Ground-Water Levels in Idaho, 1971.
W72-04819 4B

Descriptions and Chemical Analyses for Selected Wells in the Dos Palos-Kettleman City area, San Joaquin Valley, California,
W72-04843 2K

The Effects of Electrokinetics Upon Incrustation in Water Wells,
W72-04870 8A

WATER YIELD
Analysis of Colombian Precipitation to Estimate Irrigation Requirements,
W72-04806 2B

Municipal, Industrial, and Irrigation Water Use in Washington, 1970,
W72-04816 6D

Ground-Water Pumpage from the Snake Plain Aquifer, Southeastern Idaho,
W72-04820 4B

Progress Report on the Analog Model Study of the Magothy Aquifer in the Annapolis, Maryland Area.
W72-04840 4B

Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

WATER YIELD IMPROVEMENT
Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

WATERSHED MANAGEMENT
Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

WATERSHEDS (BASINS)
A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

WATERSHEDS (BASINS)
A Method for Predicting Peak Flows From Small Rural Vermont Watersheds,
W72-04897 8B

WAVE FOLLOWER
The Chesapeake Bay Institute Wave Follower--Part II,
W72-04818 7B

WAVE MAKER
On the Generation of Long Waves,
W72-05039 2E

WAVELENGTHS
Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

WAVES (WATER)
On the Generation of Long Waves,
W72-05039 2E

WEATHER MODIFICATION
Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

Hydrometeorology in Precipitation Management,
W72-04866 6B

WEATHERING
Causes of Spheroidal Weathering,
W72-04794 2J

Morphogenesis of Granitic Boulder Slopes in the Mojave Desert, California,
W72-04813 2J

WELL SCREENS
The Effects of Electrokinetics Upon Incrustation in Water Wells,
W72-04870 8A

WEST VIRGINIA
Salty Ground Water and Meteoric Flushing of Contaminated Aquifers in West Virginia,
W72-04801 5B

Records of Wells, Springs, and Test Borings, Chemical Analyses of Water, Sediment Analyses, Standard Streamflow Data Summaries, and Selected Drillers' Logs From The Little Kanawha River Basin in West Virginia,
W72-04841 7C

Cost of Reclamation and Mine Drainage Abatement-Elkins Demonstration Project,
W72-05146 5G

WESTERN US WATER DEVELOPMENT
Water and Western Destiny: From Conflict to Cooperation.
W72-04878 6B

The Future of Western Water Development,
W72-04879 6B

WHITEFISH
Detection of Clostridium Botulinum Type E in Smoked Fish,
W72-04745 5A

WINDS
Wind Stress Criteria in Eolian Sand Transport,
W72-05037 2J

WISCONSIN
Floods on Yahara River, Lake Kegonsa Dam to County Line, Dane County, Wisconsin,
W72-04815 4A

Water Resources Data for Wisconsin, 1969: Part 1. Surface Water Records, and Part 2. Water Quality Records.
W72-05094 7C

WITHDRAWAL
Ground-Water Pumpage from the Snake Plain Aquifer, Southeastern Idaho,
W72-04820 4B

Estimated Subsidence in the Raymond Basin, Los Angeles County, California, for a Postulated Water-Level Lowering, 1970-2020,
W72-04823 4B

XYLEM
Water Stress Gradients in Plants and Soil-Root Systems,
W72-05139 2G

YEASTS
Cultural Estimation of Yeasts on Seaweeds,
W72-04748 5A

ZINC
The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

ZOOPLANKTON
Population Dynamics of Selected Zooplankton in Three Oligotrophic Oregon Lakes,
W72-04763 5C

Formation of Zooplankton in the Bratsk Reservoir During the First Two Years of Impoundment, 1962i63 (Formirovaniye zooplanktona v pervyye dva goda zapolneniya Bratskogo vodokhranilishcha (1962-1963 gg.)),
W72-04857 2H

AUTHOR INDEX

ABDEL-GHANI, A. F.
Utilization of Water Hyacinth as an Organic Manure with Special Reference to Water-Borne Helminths,
W72-05115 5F

ABDOU, FAYEZ M.
The Influence of Soil Moisture on Phosphorus Uptake by Corn and on the Efficiency of Added Superphosphate,
W72-05217 3F

ABOU-EL-FADL, M.
Utilization of Water Hyacinth as an Organic Manure with Special Reference to Water-Borne Helminths,
W72-05115 5F

ACARA, A. H.
A Technique for Enumerating Kokanee Salmon (Oncorhynchus nerka) Fry Migrating Through Streams, with an Appendix for Processing Catch Data by IBM 360 Fortran IV. Computer Programs,
W72-04752 7C

ACKEFORS, H.
A Quantitative Plankton Sampler,
W72-04713 7B

ADAMS, A. P.
Coliform Aerosols Emitted by Sewage Treatment Plants,
W72-04711 5D

ADAMSE, A. D.
Some Characteristics of Arthrobacters from a Dairy Waste Activated Sludge,
W72-05103 5B

ALI, K. H. M.
Flow Over Rounded Spillways,
W72-04809 8B

ALLEN, L. H.
Advection and Evapotranspiration of Wide-row Sorghum in the Central Great Plains,
W72-05186 2D

ALLEN, L. H. JR
Carbon Dioxide Exchange of a Tropical Rain Forest: Part II,
W72-05168 2B

ALLEN, W. A.
Reflectance and Internal Structure of Cotton Leaves, Gossypium Hirsutum L.,
W72-05105 3F

ALVAREZ, J.
Action of Mineral Waters on Mineral Metabolism in Ruminants: II. Phosphorus,
W72-05111 5F

AMEND, DONALD F.
Oxytetracycline Efficacy as a Treatment for Furunculosis in Coho Salmon,
W72-04929 5C

AMIRAV, A.
Effects of Soil Moisture Stress on Two Varieties of Upland Cotton in Israel: I. The Coastal Plain Region,
W72-05179 3F

ANDERSON, E. WILLIAM
Evaluating Multiple Economic Effects of Forage Development and Management,
W72-05104 4A

ANDERSON, EMORY D.
An Automatic Brine Shrimp Feeder,
W72-04751 7B

ANDREEVA, M. I.
Comparative Evaluation of Media for Isolating Coliform Bacteria,
W72-05189 5A

ANDREWS, W. H.
Some Social Issues and Alternatives Involved in Planning Water Resources with People in the West,
W72-04889 6B

ANGINO, E. E.
Effects of Urbanization on Storm Water Runoff Quality: A Limited Experiment, Naismith Ditch, Lawrence, Kansas,
W72-05035 4C

APOSTOLSKI, K.
Acclimatization of the Israeli Carp in Lake Dojran (Macedonia), Yugoslavia,
W72-05267 2H

ARANSON, V. A.
An Active Method for Correcting the Frequency Response of the Temperature Sensors of Oceanological Instruments,
W72-04749 7B

ARMSTRONG, D. E.
Levels of Inorganic and Total Phosphorus in Lake Sediments as Related to Other Sediment Parameters,
W72-04732 5C

ARMSTRONG, W.
Oxygen Diffusion from the Roots of Rice Grown Under Non-Waterlogged Conditions,
W72-05245 3F

ARONSON, D. A.
Catalog of Recharge Basins on Long Island, N.Y., In 1969,
W72-04833 4A

ARTAMOSHIN, A. S.
Characteristics of the Epidemiology of Diphyllobothriasis in Some Lake Areas in Buryatia, (In Russian),
W72-05225 5C

ARTEMOVA, T. Z.
Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

ASPINALL, W. N.
A National Policy for Western Water Development,
W72-04895 6B

AVERETT, R. C.
Water Chemistry of the Santa Clara Valley, California,
W72-04835 2K

BAARSPUL, J. A.
The Tana Irrigation Scheme: An Integrated Development Project,
W72-05252 3F

BACHE, CARL A.
Rapid Determination of Mercury in Fish,
W72-04948 5A

BACON, PETER R.
Studies on the Biology and Cultivation of the Mangrove Oyster in Trinidad with Notes on Other Shellfish Resources,
W72-05172 2L

BAIER, W.
Concepts of Soil Moisture Availability and Their Effect on Soil Moisture Estimates from a Meteorological Budget,
W72-05149 2D

BAIN, G. L.
Records of Wells, Springs, and Test Borings, Chemical Analyses of Water, Sediment Analyses, Standard Streamflow Data Summaries, and Selected Drillers' Logs From The Little Kanawha River Basin in West Virginia,
W72-04841 7C

BAKER, E. T. JR
Relation of Ponded Floodwater from Hurricane Beulah to Ground Water in Kleberg, Kenedy, and Willacy Counties, Texas,
W72-04796 2F

BALDWIN, M. K.
Residues of Polychlorobiphenyls in Biological Samples,
W72-04754 5A

BANARESCU, PETRU
On The Importance of Temporary Pools and Their Protection, (In Rumanian),
W72-05278 2I

BANIN, A.
Election Micrographs of Lake Kinneret Sediments,
W72-04810 2J

BARBER, WILLARD E.
Some Aspects of Biology of the Longfin Dace, a Cyprinid Fish Characteristic of Streams in the Sonoran Desert,
W72-04723 2I

BARGUR, J. S.
An Intersectoral Programming Model for the Management of the Waste Water Economy of the San Francisco Bay Region,
W72-04780 5B

BARTH, RUDOLF
Biological Observations on Sardinella aurita: A. Stomach Contents (In Portuguese),
W72-05193 2I

BARTHOLIC, J. F.
Water Stress and Stem Radial Contraction of Cotton Plants (Gossypium hirsutum L.) Under Field Conditions,
W72-04961 3F

BARTHOLOMEW, W. V.
The Formation of Nitrate from Ammonium Nitrogen in Soils: IV. Use of the Delay and Maximum Rate Phases for Making Quantitative Predictions,
W72-05120 5B

BATES, JOHN M.
Cluster Analysis of Non-Insect Macro-invertebrates of the Upper Potomac River,
W72-05134 5C

BATES, R. G.
Potassium Fluoride - A Reference Standard for Fluoride Ion Activity,
W72-04741 5A

BAUMANN, E. ROBERT
Advanced Organics Removal by Pulsed Adsorption Beds,
W72-05005 5D

BEAUMONT, P.
Qanat Systems in Iran,
W72-04849 4B

BECHER, H. H.
Results of Hydraulic Conductivity Measurements in the Unsaturated State (In German),
W72-04781 2G

BELISLE, ANDRE A.
Semiquantitative Determination of Polychlorinated Biphenyls in Tissue Samples by Thin Layer Chromatography,
W72-04946 5A

BELYAYEVA, L. V.
An Active Method for Correcting the Frequency Response of the Temperature Sensors of Oceanological Instruments,
W72-04749 7B

BERG, A. R.
Ecological and Physiological Implications of Greenbelt Irrigation,
W72-04898 6G

BERGLUND, JOHN V.
Annual Soil Moisture-Temperature Patterns as Influenced by Irrigation,
W72-05137 2G

BERNATOVA, V.
Biological and Bacteriological Evaluation of Pilot Plant Artificial Recharge Experiments,
W72-05143 4B

BERTOLDI, G. L.
Descriptions and Chemical Analyses for Selected Wells in the Dos Palos-Kettleman City area, San Joaquin Valley, California,
W72-04843 2K

BERZILOV, V. F.
Possibility of Reduction of Plant Transpiration During Summer Transplantations by Means of Antitranspirants, (In Russian),
W72-05253 2D

BETZER, PETER
Removal of Trace Metals From Marine Culture Media,
W72-04708 5A

BEZZEGH-GALANTAI, MARIA MAGDOLNA
Decontamination of Radioactively Poisoned Water with Peat Filters, (In German),
W72-05224 5G

BHAGAT, SURINDER K.
Trace Element Analysis of Environmental Samples by Neutron Activation Method,
W72-04998 5A

BICK, HARTMUT
Comparative Studies of Peptone Degradation and the Correlated Population of Ciliates in Models of Flowing and Stagnant Water,
W72-04909 5C

BIGGAR, J. W.
Specific Conductance Model for Natural Waters and Soil Solutions of Limited Salinity Levels,
W72-05053 2G

BILLARD, R.
Sterilization of the Testicles of Guppies by Means of Non-Lethal Doses of Parathion (In French),
W72-05191 5C

BILTON, H. T.
A Hypothesis of Alternation of Age of Return in Successive Generations of Skeena River Sockeye Salmon (Oncorhynchus nerka),
W72-04755 2I

BINGHAM, J. R.
A Review of Inter-Regional and International Water Transfer Proposals,
W72-04883 6B

BIRD, E. C. F.
The Disappearing Mitchell Dekta,
W72-05156 4D

BIRNAURE, I.
A Study of the Variation of Water Level and Mineralization of the Ground Water in the Danube Drainage Area 'Boianu-Sticlenau' (In Rumanian),
W72-05169 5C

BLACK, T. A.
Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

BLAHM, THEODORE H.
Effects of Increased Temperature on Cold-Water Organisms,
W72-04764 5C

BLEDSOE, B. E.
Probable Impact of NTA on Ground Water,
W72-04800 5B

BLEVINS, R. L.
Influence of No-Tillage on Soil Moisture,
W72-05155 2G

BOAWN, L. C.
Phosphorus Fertilization of Hops,
W72-05148 5B

BOCHKOV, N. M.
Long-Term Water-Quality Characteristics of the Bratsk Reservoir and Forecast of Organic Matter Accumulation (Mnogoletnyaya kharakteristika formirovaniya kachestva vody i prognoz nakopleniya organicheskogo veshchestva v Bratskom vodok hranilishche),
W72-04859 5C

BOLAN, R. S.
Community Decision Behavior: The Culture of Planning,
W72-04760 6A

BOLLE, ARNOLD W.
Public Participation and Environmental Quality,
W72-04839 6A

BORHAUG, J. E.
The Response of Substation Bus Systems to Short Circuit Conditions: Part I, II, III,
W72-04862 8C

BORMANN, F. H.
Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

BOUSH, G. MALLORY
Phenylmercuric Acetate: Metabolic Conversion by Microorganisms,
W72-05138 5C

BOWLES, BARBARA
Some Quantitative Algal Studies of the River Thames,
W72-04963 5C

BOYD, J. W.
Effects of Sodium Chloride on Outgrowth and Toxin Production of Clostridium botulinum Type E in cod Homogenates,
W72-04737 5C

BOYER, J. S.
Recovery of Photosynthesis in Sunflower After a Period of Low Leaf Water Potential,
W72-05243 2I

BOYLE, W. C.
Identification of Filamentous Microorganisms in Activated Sludge,
W72-04984 5B

BRAMHALL, E. L.
Dead Bird Disposal by Rendering,
W72-05055 5E

BRECKLE, S. W.
Annual Changes in Osmotic Conditions and Carbohydrate Contents in East-Afghanistan Trees I. Quercus Balout Griffith, (In German),
W72-05260 2I

BREZONIK, P. L.
Denitrification as a Nitrogen Sink in Lake Mendota, Wisconsin,
W72-05130 5B

BROADY, M.
The Social Context of Urban Planning,
W72-04758 6B

BROMEL, M. C.
Bacterial Counts of a Section of the Red River -- Summer, 1970,
W72-05056 5A

BRONN, C.
The Third Western Interstate Water Conference of Colorado State University,
W72-04886 6B

BROWN, F.
The Growth of Pores in Graphitized Carbon Reacted with Carbon Dioxide,
W72-04704 5D

BROWN, F. L.
The Reuse of Water in Manufacturing: An Explanatory Economic Model with Data Analysis,
W72-05093 3E

BROWN, LAUREN E.
Natural Hybridization and Reproductive Ecology of Two Toad Species in a Disturbed Environment,
W72-05117 2I

BRUMMER, GERHARD
Contributions to the Genesis and Classification of Marsh Soils: II. On the Sulphur Metabolism of Muds and Salt Marshes, (In German),
W72-04924 2G

BRUSVEN, M. A.
Effects of Siltation and Coarser Sediments on Distribution and Abundance of Stream-Inhabiting Insects,
W72-05024 5C

BUCHANAN, M. L.
Handling Livestock Waste,
W72-05057 5D

BUCHOLTZ, H. F.
Dried Poultry Waste as a Protein Source for Feedlot Cattle,
W72-05064 5E

BUCHURIN, A. A.
Strontium-90, Strontium and Calcium in some Aquatic Organisms from the Sea of Okhotsk, (In Russian),
W72-04999 5A

BULLOCK, G. L.
Oxytetracycline Residues in Different Tissues of Trout,
W72-04928 5C

Oxytetracycline Sensitivity of Selected Fish Pathogens,
W72-04932 5C

BURK, C. JOHN
The Mill River and Its Floodplain in Northampton and Williamsburg, Mass.: A Study of the Vascular Plant Flora, Vegetation, and the Presence of the Bacterial Family Pseudomonadaceae in Relation to Patterns of Land Us e,
W72-05092 5C

BURNETT, W. E.
Analyses of Gases Encountered in a Commercial Poultry House,
W72-05070 5A

Odor Controls by Chemical Treatment,
W72-05074 5D

Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

Particulate Matter,
W72-05072 5A

The Qualitative Determination of the Odor Quality of Chicken Manure,
W72-05068 5B

The Quantitative Determination of the Odor Strength of Chicken Manure,
W72-05069 5A

Soil Filtration to Remove Odors,
W72-05073 5D

BURROWS, ROGER E.
The Abernathy Salmon Diet,
W72-04728 2I

BURT, E. M.
The Use, Abuse and Recovery of a Glacial Aquifer,
W72-04802 5B

BUSBY, FRANK E. JR
Woody Phreatophyte Infestation of the Middle Brazos River Floodplain,
W72-05231 3B

BUSS, KEEN
Considerations for Conventional Trout Hatchery Design and Construction in Pennsylvania,
W72-04934 8I

CABELLI, VICTOR J.
The Elimination of Bacteria by the Northern Quahog: Variability in the Response of Individual Animals and the Development of Criteria,
W72-04944 5C

Seasonal Factors Relevant to Coliform Levels in the Northern Quahaug,
W72-04945 5C

CAIN, S. A.
The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

CAIRNS, JOHN JR
Cluster Analysis of Non-Insect Macro-invertebrates of the Upper Potomac River,
W72-05134 5C

CALDWELL, LYNTON K.
Environmental Policy in a Hypertrophic Society,
W72-04938 6B

CALDWELL, MARTYN M.
The Effect of Wind on Stomatal Aperture, Photosynthesis, and Transpiration of Rhododendron ferrugineum L. and Pinus cembra L.,
W72-05108 2I

CAMBEROS, H. R.
Action of Mineral Waters on Mineral Metabolism in Ruminants: II. Phosphorus,
W72-05111 5F

CAMPBELL, J.
Making Water Resources Planning Relevant,
W72-04881 6B

CAMPBELL, R.
Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

CANZONIER, WALTER J.
Accumulation and Elimination of Coliphage S-13 by the Hard Clam, Mercenaria Mercenaria,
W72-04953 5C

CARDENAS, R.
Reflectance and Internal Structure of Cotton Leaves, Gossypium Hirsutum L.,
W72-05105 3F

CARLANDER, K. D.
Age, Growth and Condition of Black Crappie, Pomoxis nigromaculatus (Le Sueur), in Lewis and Clark Lake, South Dakota, 1954 to 1967,
W72-05264 2H

CARLSON, J. W.
Water Resource Investments and National Goals,
W72-04891 6B

CARPENTER, EDWARD J.
Annual Phytoplankton Cycle of the Cape Fear River Estuary, North Carolina,
W72-04902 2L

Effects of Phosphorus Mining Wastes on the Growth of Phytoplankton in the Pamlico River Estuary,
W72-04906 5C

CARR, R. M.
Complexes of Halloysite with Organic Compounds,
W72-05043 2K

CARR, RICHARD L.
Collaborative Study of a Method for Multiple Chlorinated Pesticide Residues in Fish,
W72-04947 5A

CARRIGAN, P. H. JR
A Flood-Frequency Relation Based on Regional Record Maxima,
W72-04797 2E

CARTER, JOHN A.
Dual Substrate Utilization by Activated Sludge Microflora,
W72-04990 5D

CARY, J. W.
Plant Water Potential Gradients Measured in the Field by Freezing Point,
W72-05239 3F

CASTAGNA, MICHAEL
Rearing the Bay Scallop, Aequipecten Irradians,
W72-04724 2I

CATALFAMO, MAGDALENA
Nutrients and Carbon Dioxide in the Columbia River,
W72-04974 5B

CAULFIELD, H. P.
A Look Ahead in Planning Coordination and Policy Making,
W72-04884 6B

CECIL, EDWARD A.
Research on Dry-Type Cooling Towers for Thermal Electric Generation: Part I,
W72-04829 5D

CHAPMAN, A. L.
A Physical Analysis of Diurnal Temperature Regimes in Clear and Turbid Water Layers: A Problem in Rice Culture,
W72-05144 2D

CHAPPELL, C. F.
Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

CHEKAL', V. N.
A Hygienic Evaluation of the New Plasticizer Tolylnaphthylmethane,
W72-05236 5C

CHERVINSKI, J.
Studies on Carp Nutrition: III. Experiments on the Affect on Fish Yield of Dietary Protein Source and Concentration,
W72-05266 2I

CHIH, H.
Complexes of Halloysite with Organic Compounds,
W72-05043 2K

CHILIKOV, I.
Influence of Soil Moisture and Submergence of Rice Fields on Emergence and Initial Development of Rice (In Bulgarian),
W72-05171 3F

CHITRAVADIVELU, KARTHIGESU
Growth of Chondrostoma nasus (Linnaeus, 1758) in Dunajec and Raba of the Upper Vistula River System,
W72-05263 2I

CHRISTIAN, RUSSEL F.
The Total Organic Carbon Analyzer and Its Application to Water Research,
W72-05001 5A

CHUNG, YUNG HO
A Study on the Brackish Water Type on the Han River Estuary (In Korean),
W72-05203 2L

CHVAPIL, J.
Virological Surveys of the Presence of Enteroviruses in Waste Water: I. Incidence of Polio-viruses in Prague at the End of 1963 and in 1969, (In Czech),
W72-05226 5B

CLAREN, R.
The Vibrations of Transmission Line Conductor Bundles,
W72-04863 8C

CLARK, A. C.
Seasonal Calorific Values of Freshwater Zooplankton, as Determined with a Phillipson Bomb Calorimeter Modified for Small Samples,
W72-04912 2H

CLUSEN, D. E.
Improving the Planning Process--Establishing Values,
W72-04888 6B

COLE, D. F.
Effect of Growth Regulator and Anti-Transpirant Chemicals on Water Requirement and Growth Components of Alfalfa (Medicago sativa L.),
W72-05232 3F

COLLINS, A. G.
Solubility of Barium and Strontium Sulfates in Strong Electrolyte Solutions,
W72-04793 5G

COLLIS, DIANE
Oxytetracycline Residues in Different Tissues of Trout,
W72-04928 5C

Oxytetracycline Sensitivity of Selected Fish Pathogens,
W72-04932 5C

CONLEY, WALTER R.
Recent Experiences in Plant-Scale Application of the Settling Tube Concept,
W72-04991 5D

COOK, DOYLE
Influence of No-Tillage on Soil Moisture,
W72-05155 2G

CORKER, CHARLES E.
Groundwater Law, Management and Administration,
W72-05101 6E

COSBY, R. L.
Probable Impact of NTA on Ground Water,
W72-04800 5B

COWGILL, URSULA
Ianula: An Account of the History and Development of the Lago Di Monterosi, Latium, Italy: XIII. The History of the Lake: A Synthesis,
W72-05209 5C

CRABTREE, A. N.
Residues of Polychlorobiphenyls in Biological Samples,
W72-04754 5A

CRAUL, PHILLIP J.
Annual Soil Moisture-Temperature Patterns as Influenced by Irrigation,
W72-05137 2G

CRIPPS, J. E. L.
The Influence of Soil Moisture on Apple Root Growth and Root:Shoot Ratios,
W72-05246 2I

CROMARTIE, EUGENE
Semiquantitative Determination of Polychlorinated Biphenyls in Tissue Samples by Thin Layer Chromatography,
W72-04946 5A

CRONIN, W. B.
Volumetric, Areal, and Tidal Statistics of The Chesapeake Bay Estuary and Its Tributaries,
W72-04838 2L

CROSBY, JAMES W. III
Groundwater Law, Management and Administration,
W72-05101 6E

CROSBY, O. A.
Thermal Study of the Missouri River in North Dakota Using Infrared Imagery,
W72-04824 5B

CROWLE, W. L.
Relations between Water Status, Leaf Temperature Stomatal Aperture, and Productivity of Some Wheat Varieties (In German),
W72-05185 3F

CUINAT, ROBIN
Ecology and the Repopulation of Trout Streams,
W72-05268 2I

CULP, DALE A.
The Analysis of Mercury in Urine, Blood, Water, and Air,
W72-05113 5A

CURRAN, DONALD
Oxytetracycline Efficacy as a Pretreatment Against Columnaris and Furunculosis in Coho Salmon,
W72-04930 5C

DABIRI, H.
Numerical Modeling of Unsaturated Groundwater Flow Including Effects of Evapotranspiration,
W72-05089 2G

DALE, J. L.
The Relationship of Drying Temperature to Total Crude Protein in Dried Poultry Waste,
W72-05062 5E

DALINSKY, S.
The Use of Non-Dimensional One-Parameter Functions For The Determination of Regional Rainfall Depth-Duration-Frequency Relations,
W72-05047 2A

DALLIN, JENSEN W.
Administrative Allocation of Water,
W72-04786 6E

DALTON, F. N.
In Situ Measurement of Soil and Plant Leaf Water Potential,
W72-05136 2D

DANKS, H. V.
Spring and Early Summer Temperatures in a Shallow Arctic Pond,
W72-05163 2C

DAVEY, EARL W.
Removal of Trace Metals From Marine Culture Media,
W72-04708 5A

DAVIS, CLIFFORD
Riparian Water Law. A Functional Analysis,
W72-05097 6E

DAVIS, H. C.
An Intersectoral Programming Model for the Management of the Waste Water Economy of the San Francisco Bay Region,
W72-04780 5B

DAVIS, J. W.
Solubility of Barium and Strontium Sulfates in Strong Electrolyte Solutions,
W72-04793 5G

DAVIS, ROBERT M.
Histological Comparisons of the Adrenal-Cortical Cells of Hatchery and Wild Landlocked Atlantic Salmon (Salmo salar),
W72-04960 5C

DAVIS, RONALD G.
Growth Patterns of Irrigated Sugarbeet Roots and Tops,
W72-04915 3F

DE ROO, H. C.
Water Stress Gradients in Plants and Soil-Root Systems,
W72-05139 2G

DE VILLIERS, J. F. V. D. S.
Fluoridation: The Past 25 Years,
W72-05235 5F

DEAN, JACK L.
Biology of the Crayfish Orconectes causeyi and Its Use for Control of Aquatic Weeds in Trout Lakes,
W72-04962 4A

DECKER, K.
Energy Production in Anaerobic Organisms,
W72-05018 5D

DENT, W. C.
The Role of Recreation and Environmental Quality in Water Management,
W72-04894 6B

DEVOS, R. H.
Characterization of Four Major Components in a Technical Polychlorinated Biphenyl Mixture,
W72-04730 5A

DEWSNUP, RICHARD L.
Legal Aspects of Water Salvage,
W72-05098 6E

Legal Protection of Instream Water Values,
W72-05099 6E

Public Access Rights in Waters and Shorelands,
W72-05100 6E

DI TORO, D. M.
Recurrence Relations for First Order Sequential Reactions in Natural Waters,
W72-05027 5B

DIAPER, E. W. J.
Microstraining of Combined Sewer Overflows,
W72-04971 5D

DICKSON, I. W.
Factors Influencing Scope for Activity and Active and Standard Metabolism of Rainbow Trout (Salmo gairdneri),
W72-04958 5C

DIECKMAN, J. F.
Combined High Speed Liquid Chromatography and Bioassay for the Evaluation and Analysis of an Organophosphorus Larvacide,
W72-04997 5A

DIMANCEA, S.
A Study of the Influence of Nitrogen and Phosphorus Fertilizers on the Corn Grown on the Alluvial Soils of the Danube Flooded Area,
W72-05116 2G

DINGENS, P.
A Truncated Square-Root-Normal Distribution Applied to Monthly Precipitation Totals for Ghent (Belgium),
W72-05048 2B

DINGMAN, S. L.
Equilibrium Temperatures of Water Surfaces as Related to Air Temperature and Solar Radiation,
W72-05026 2B

DOLCATER, D. L.
Cation Exchange Selectivity of Some Clay-Sized Minerals and Soil Materials,
W72-05127 2K

DOMINY, F. E.
Partial Solutions--The Outlook,
W72-04890 6B

DONDERO, N. C.
Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

Soil Filtration to Remove Odors,
W72-05073 5D

DONNELLON, J.
Toxic Effects of Ammonia Nitrogen in High-Rate Digestion,
W72-05015 5D

DORN, D.
The Relationship of Drying Temperature to Total Crude Protein in Dried Poultry Waste,
W72-05062 5E

DORN, D. A.
The Effects of Continually Recycling Dehydrated Poultry Wastes (DPW) on the Performance of SCWL Laying Hens -- A Preliminary Report,
W72-05066 5E

DORRENZ, A. K.
Effect of Growth Regulator and Anti-Transpirant Chemicals on Water Requirement and Growth Components of Alfalfa (Medicago sativa L.),
W72-05232 3F

DOWKER, B. D.
Breeding of Maize for Low Rainfall Areas of Kenya: I. The Reliability of Yield of Early and Later Maturing Maizes,
W72-04916 3F

DOWNEY, LLOYD A.
Effect of Gypsum and Drought Stress on Maize (Zea mays L.): I. Growth, Light Absorption and Yield,
W72-05188 3F

Effect of Gypsum and Drought Stresses on Maize (Zea Mays L.): II. Consumptive Use of Water,
W72-04917 3F

DRAGANOV, D.
Influence of Soil Moisture and Submergence of Rice Fields on Emergence and Initial Development of Rice (In Bulgarian),
W72-05171 3F

DRUCE, R. G.
An Ecological Study of the Psychrotrophic (SIC) (Psychrophilic) Bacteria of Soil, Water, Grass and Hay,
W72-05158 5B

DUCKSTEIN, L.
Space-Time Sampling of Ecological Systems,
W72-04779 6A

DUDDERAR, T. D.
Laser Holography and Interferometry in Materials Research,
W72-04873 7B

DUER, W. C.
Potassium Fluoride - A Reference Standard for Fluoride Ion Activity,
W72-04741 5A

DUGGAN, WILLIAM
Rearing the Bay Scallop, Aequipecten Irradians,
W72-04724 2I

DUKE, J. H.
Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

Streamflow, Groundwater and Ground Response Data--Volume II, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05096 7C

DUKE, V. C.
Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

Streamflow, Groundwater and Ground Response Data--Volume II, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05096 7C

DUMAS, A. J.
Detection of a Change in Runoff by an Analysis of Daily Flows,
W-72 04846 2A

DUMEYER, J. M.
Hydrologic Data for the San Luis Valley, Colorado,
W72-05025 7C

DUNLAP, W. J.
Probable Impact of NTA on Ground Water,
W72-04800 5B

DURKIN, JOSEPH T.
Distribution and Movement of Juvenile Salmon in Brownlee Reservoir, 1962-65,
W72-04768 2H

EAGLESON, P. S.
Evaluation of Radar and Raingage Systems for Flood Forecasting,
W72-04966 2B

A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

EDWARD, CLYDE W.
Administrative Allocation of Water,
W72-04786 6E

EDWARDS, D. M.
The Effects of Electrokinetics Upon Incrustation in Water Wells,
W72-04870 8A

EHRLICH, H. L.
Bacteriology of Manganese Nodules: V. Effect of Hydrostatic Pressure on Bacterial Oxidation of MnII and Reduction of MnO2,
W72-05129 5C

EICHELBERGER, JAMES W.
Persistence of Pesticides in River Water,
W72-04922 5B

EL-MOFTY, M. K.
Utilization of Water Hyacinth as an Organic Manure with Special Reference to Water-Borne Helminths,
W72-05115 5F

EL NENNAH, M.
The Influence of Soil Moisture on Phosphorus Uptake by Corn and on the Efficiency of Added Superphosphate,
W72-05217 3F

ELDER, H. Y.
Natural Hybrids of the African Cichlid Fishes Tilapia spirlurus nigra and T. leucosticta: A Case of Hybrid Introgression,
W72-05270 2I

ELLER, J. M.
Analytical Parameters of Petrochemical and Refinery Wastewaters,
W72-05014 5D

ELLIOTT, J. M.
The Distances Travelled by Drifting Invertebrates in a Lake District Stream,
W72-05274 2I

Life Histories and Drifting of Three Species of Limnephilidae (Trichoptera),
W72-04714 5A

ELLIS, D. W.
Floods of July 4-8, 1969 in North-Central Ohio,
W72-04852 2E

ELSON, B. M.
Earth Resource Technology Used in Pollution Detection,
W72-04742 5A

EMERY, P. A.
Hydrologic Data for the San Luis Valley, Colorado,
W72-05025 7C

EMERY, RICHARD M.
The Total Organic Carbon Analyzer and Its Application to Water Research,
W72-05001 5A

ENGELBERT, E. A.
The Future of Western Water Development,
W72-04879 6B

ERICKSON, STANTON J.
Removal of Trace Metals From Marine Culture Media,
W72-04708 5A

ERMAN, D. C.
Comparison of Some Species Importance Values and Ordination Techniques Used to Analyse Benthic Invertebrate Communities,
W72-04716 5A

ESMAY, M. L.
Drying of Poultry Manure in a Cage-Layer House,
W72-05063 5E

ESTABLIER, RAFAEL
Phytoplankton and Hydrography of the Bay of Cadiz in 1969, (In Spanish),
W72-05254 5A

FADRUS, HUBERT
Influence of Temperature on Anaerobic Digestion,
W72-05010 5D

FAGADE, S. O.
The Food and Feeding Habits of Tilapia Species in the Lagos Lagoon,
W72-04705 2L

FAIRBANK, W. C.
Dead Bird Disposal by Rendering,
W72-05055 5E

FALL, EDWIN B. JR
Redesigning Existing Facilities to Increase Hydraulic and Organic Loading,
W72-05004 5D

FANG, C. S.
Groundwater Flow in a Sandy Tidal Beach: Two-Dimensional Finite Element Analysis,
W72-05033 2F

FARAMELLI, N. J.
Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

FARQUHAR, G. J.
Identification of Filamentous Microorganisms in Activated Sludge,
W72-04984 5B

FAUGERE, J. G.
Bordeaux: Study of Atmospheric Pollution on the Built-Up Area,
W72-04923 5B

FAUSEY, N. R.
Soil Moisture Content, Tilth, and Soybean Response with Surface and Subsurface Drainage,
W72-05145 2G

FEDERER, C. A.
Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

New Landmark in the White Mountains,
W72-05080 2A

Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

FENDERSON, OWEN C.
Histological Comparisons of the Adrenal-Cortical Cells of Hatchery and Wild Landlocked Atlantic Salmon (Salmo salar),
W72-04960 5C

FERGUSON, JOHN F.
Effects of Carbonate and Magnesium on Calcium Phosphate Precipitation,
W72-04949 5D

FERNANDEZ, PEDRO CARLOS
Intermittent Leaching, A Recommended Technique for the Reclamation of Saline Soils, (In Spanish),
W72-05228 2G

FIGUEIRAS, H. D.
Action of Mineral Waters on Mineral Metabolism in Ruminants: II. Phosphorus,
W72-05111 5F

FILBY, ROYSTON H.
Trace Element Analysis of Environmental Samples by Neutron Activation Method,
W72-04998 5A

FINLAYSON, G. D.
A Note on Inexpensive Telemetry of River Sediment Concentrations,
W72-05049 7B

FISHER, H. D.
Plant Water Potential Gradients Measured in the Field by Freezing Point,
W72-05239 3F

FLEGAL, C. J.
Dried Poultry Waste as a Protein Source for Feedlot Cattle,
W72-05064 5E

Economics of Dried Poultry Waste (DPW) as a Feed Ingredient or a Fertilizer,
W72-05060 5E

The Effects of Continually Recycling Dehydrated Poultry Wastes (DPW) on the Performance of SCWL Laying Hens -- A Preliminary Report,
W72-05066 5E

The Metabolizeable Energy Value of Dried Poultry Waste,
W72-05065 5E

The Relationship of Drying Temperature to Total Crude Protein in Dried Poultry Waste,
W72-05062 5E

FLEMER, DAVID A.
Daylight Incubator Estimates of Primary Production in the Mouth of the Patuxent River, Maryland,
W72-04904 2L

FLETCHER, J. E.
Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

FLORESCU, G.
A Study of the Variation of Water Level and Mineralization of the Ground Water in the Danube Drainage Area 'Boianu-Sticlenau' (In Rumanian),
W72-05169 5C

FLORIAN, R. L.
Plant Growth-Evapotranspiration Relations for Several Crops in the Central Great Plains,
W72-05147 2D

FLOWER, R. J.
The Chesapeake Bay Institute Wave Follower--Part II,
W72-04818 7B

FOEHNER, O. H.
Hydrometeorology in Precipitation Management,
W72-04866 6B

FORD, D. L.
Analytical Parameters of Petrochemical and Refinery Wastewaters,
W72-05014 5D

FORSGATE, J. A.
Rainfall and Run-off from an Industrial Area in Nairobi, Kenya,
W72-04837 4C

FOSTER, G. N.
The Distribution of Aquatic Coleoptera in Anglesey,
W72-05272 2I

FOWLER, LAURIE G.
The Abernathy Salmon Diet,
W72-04728 2I

FOX, W. T.
Coastal Sedimentation of Southeastern Lake Michigan, Field Trip Guidebook,
W72-04807 2J

FRAUENGLASS, HARVEY
Environmental Policy: Public Participation and the Open Information System,
W72-05132 6E

FREDERICK, L. R.
The Formation of Nitrate from Ammonium Nitrogen in Soils: IV. Use of the Delay and Maximum Rate Phases for Making Quantitative Predictions,
W72-05120 5B

FRIEL, E. A.
Records of Wells, Springs, and Test Borings, Chemical Analyses of Water, Sediment Analyses, Standard Streamflow Data Summaries, and Selected Drillers' Logs From The Little Kanawha River Basin in West Virginia,
W72-04841 7C

FRIND, E. O.
Application of Galerkin's Procedure to Aquifer Analysis,
W72-05032 2F

FRYE, J. C.
Farmdalian Lake Deposits and Faunas in Northern Illinois,
W72-04834 2H

FRYREAR, D. W.
Survival and Growth of Cotton Plants Damaged by Windblown Sand,
W72-04918 3F

FUJIHARA, M. P.
Chondrococcus columnaris Disease of Fishes: Influence of Columbia River Fish Ladders,
W72-04959 5B

FUNK, WILLIAM H.
Trace Element Analysis of Environmental Samples by Neutron Activation Method,
W72-04998 5A

GABRYSCH, R. K.
Records of Wells, Drillers' Logs, and Chemical Analysis of Ground Water in Galveston County, Texas 1952-1970,
W72-04795 4B

GAL, M.
Election Micrographs of Lake Kinneret Sediments,
W72-04810 2J

GANS, H. J.
Planning for People, Not Buildings,
W72-05133 6B

GARDNER, GEORGE R.
Histological and Hematological Responses of an Estuarine Teleost to Cadmium,
W72-04709 5C

GARDNER, H. R.
Advection and Evapotranspiration of Wide-row Sorghum in the Central Great Plains,
W72-05186 2D

Plant Growth-Evapotranspiration Relations for Several Crops in the Central Great Plains,
W72-05147 2D

GARDNER, W. R.
In Situ Measurement of Soil and Plant Leaf Water Potential,
W72-05136 2D

GARROD, D. J.
Natural Hybrids of the African Cichlid Fishes Tilapia spirlurus nigra and T. leucosticta: A Case of Hybrid Introgression,
W72-05270 2I

GARTON, RONALD R.
Guidelines: Biological Surveys at Proposed Heat Discharge Sites,
W72-04828 5G

GAUDY, A. F. JR
Operational Stability of the Extended Aeration Process,
W72-04784 5D

GAUSMAN, H. W.
Reflectance and Internal Structure of Cotton Leaves, Gossypium Hirsutum L.,
W72-05105 3F

GEBHART, L. R.
Experimental Cationic Asphalt Emulsion Grouting,
W72-04869 8G

GEE, H.
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

GEE, HENRY
Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

GEINOPOLOS, ANTHONY
Process Evaluation--Phosphorus Removal,
W72-04979 5D

GEISLER, R.
Ecology of Freshwater Fishes in Amazonia: Present State of Knowledge and Future Problems, (In German),
W72-05277 2I

GELIN, C.
Primary Production and Chlorophyll a Content of Nanoplankton in a Eutrophic Lake,
W72-04717 5C

GENTILE, JOHN H.
Removal of Trace Metals From Marine Culture Media,
W72-04708 5A

GERKING, SHELBY D.
Influence of Rate of Feeding and Body Weight on Protein Metabolism of Bluegill Sunfish,
W72-05262 2I

GHELBERG, NAUM W.
Experimental Investigations into the Influence of Some Organic-Phosphoric Insecticides on the Oxygen Content of Water, (In German),
W72-05258 5C

GHOSH, MRINGANKA M.
Abatement of Pollution From a Poultry Processing Plant,
W72-05006 5D

GLADKOV, I. M.
Comparative Evaluation of Media for Isolating Coliform Bacteria,
W72-05189 5A

GLINKA, Z.
The Effect of Epidermal Cell Water Potential on Stomatal Response to Illumination of Leaf Discs of Vicia faba,
W72-05240 2I

GLOVER, G. E.
Microstraining of Combined Sewer Overflows,
W72-04971 5D

GLOYNA, E. F.
Analytical Parameters of Petrochemical and Refinery Wastewaters,
W72-05014 5D

GOLDMAN, J. C.
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

GOLUEKE, CLARENCE G.
Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

GOMEZ, M.
The Metabolizeable Energy Value of Dried Poultry Waste,
W72-05065 5E

GORDEN, ROBERT W.
Ecology of Heterotrophic Aerobic Bacteria of Playa Lakes and Microcosms,
W72-04905 5C

GORDON, ROBERT W.
Toxicity and Oxygen Demand of Decaying Bark,
W72-04957 5C

GORE, R. C.
Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides,
W72-04738 5A

GORMEL, B.
Odor Controls by Chemical Treatment,
W72-05074 5D

GOTOH, YOSHIKO
Phenylmercuric Acetate: Metabolic Conversion by Microorganisms,
W72-05138 5C

GOULDEN, CLYDE E.
Ianula: An Account of the History and Development of the Lago Di Monterosi, Latium, Italy: VIII. The Fossil Flora and Fauna (Other Than Siliceous Fossils, Pollen, and Chironomid Head Capsules),
W72-05207 5C

GOULDER, R.
Vertical Distribution of Some Ciliated Protozoa in Two Freshwater Sediments,
W72-04718 5C

GRADWELL, M. W.
The Available-Water Capacities of North Auckland Soils,
W72-05234 2G

GRAY, J. R.
Seasonal Calorific Values of Freshwater Zooplankton, as Determined with a Phillipson Bomb Calorimeter Modified for Small Samples,
W72-04912 2H

GRAY, T. N.
Effect of Water Table Depth and Flooding on Yield of Millet,
W72-05124 2G

GRAYMAN, W. M.
Evaluation of Radar and Raingage Systems for Flood Forecasting,
W72-04966 2B

GREEN, D. W.
Numerical Modeling of Unsaturated Groundwater Flow Including Effects of Evapotranspiration,
W72-05089 2G

GREEN, L. R.
Ecological and Physiological Implications of Greenbelt Irrigation,
W72-04898 6G

GRIMES, CHURCHILL B.
Thermal Addition Studies of the Crystal River Stream Electric Station,
W72-05201 5C

GRUNDY, R. D.
Strategies for Control of Man-Made Eutrophication,
W72-04734 5D

GRUNWALDT, HANS SIEGFRIED
Contributions to the Genesis and Classification of Marsh Soils: II. On the Sulphur Metabolism of Muds and Salt Marshes, (In German),
W72-04924 2G

GUERIN, J. P.
Experimental Study of the Formation of a Population on Loose Ground from Meroplanktonic Larvae, (In French),
W72-05256 7B

GUINTHER, ERIC B.
Ecologic Observations on an Estuarine Environment at Fanning Atoll,
W72-05213 2L

GUTZ, MANFRED
Experimental Studies on Adaptation to Salinity Shown by the Different Races of the Three-Spined Stickleback (Gasterosteus aculeatus L.), (In German),
W72-05259 2L

HACKETT, B.
Ecology and Technology in Twentieth-Century Landscapes,
W72-04980 6B

HALL, JOHN R.
Mollusks and Benthic Environments in Hillsborough Bay, Florida,
W72-04772 2L

HALL, MILLARD W.
Abatement of Pollution From a Poultry Processing Plant,
W72-05006 5D

HAMAWI, H.
Effect of 2-Chloro-Ethyltrimethyl-Ammonium Chloride (CCC) and Urea on Shedding of Young Bolls and Yield of Cotton Plants Under Frequent and Infrequent Irrigation,
W72-05229 3F

HAMDI, H.
The Influence of Soil Moisture on Phosphorus Uptake by Corn and on the Efficiency of Added Superphosphate,
W72-05217 3F

HAMMER, MARK J.
Eutrophication of Small Reservoirs in the Great Plains,
W72-04759 5C

Eutrophication of Small Reservoirs in the Great Plains,
W72-04761 5C

HAMMER, U. T.
Limnological Studies of the Lakes and Streams of the Upper Qu,Appelle River System, Saskatchewan, Canada: I. Chemical and Physical Aspects of the Lakes and Drainage System,
W72-04975 5C

HAMMERSCHLAG, D.
Nuclear Energy for a New Town,
W72-05091 6G

HAMMOUDA, MOHAMED AHMED
The Water Outlay by Eichhornia crassipes and Observations on the Plant Chemical Control,
W72-05247 4A

HANES, N. BRUCE
Toxicity of Seawater to Coliform Bacteria,
W72-04757 5C

HANKS, R. J.
Advection and Evapotranspiration of Wide-row Sorghum in the Central Great Plains,
W72-05186 2D

Plant Growth-Evapotranspiration Relations for Several Crops in the Central Great Plains,
W72-05147 2D

HANN, R. W.
Hymo, A Problem-Oriented Computer Language for Building Hydrologic Models,
W72-05028 7C

HANNA, GEORGE P. JR
Algal-Bacterial Symbiosis for Removal and Conservation of Wastewater Nutrients,
W72-04983 5D

HANNA, T. H.
The Load Movement Behavior of Long Piles,
W72-04872 8D

HANNAH, R. W.
Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides,
W72-04738 5A

HANSEN, W. R.
210PoO2 Movement in a Mountain Watershed Soil,
W72-04920 5B

HANSON, ARTHUR M.
Forms of Inorganic Nitrogen in Domestic Wastewater,
W72-04981 5A

HARADA, K.
Study on the New Strain of the Pathogenic 'Vibrio' Isolated from Freshwater Fishes,
W72-04720 5A

HARDEE, J. E.
Analysis of Colombian Precipitation to Estimate Irrigation Requirements,
W72-04806 2B

HARENBERG, W. A.
Ground-Water Pumpage from the Snake Plain Aquifer, Southeastern Idaho,
W72-04820 4B

HARKINS, RALPH D.
Guidelines: Biological Surveys at Proposed Heat Discharge Sites,
W72-04828 5G

HARLEY, B. M.
A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

HARRIS, R. F.
Levels of Inorganic and Total Phosphorus in Lake Sediments as Related to Other Sediment Parameters,
W72-04732 5C

HARRISON, J. E.
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

HARRISON, W.
Groundwater Flow in a Sandy Tidal Beach: Two-Dimensional Finite Element Analysis,
W72-05033 2F

HARWOOD, J. E.
A Colorimetric Method for Ammonia in Natural Waters,
W72-04964 5A

HASHIMOTO, A. G.
Gases and Odors from Undiluted and Diluted Chicken Manure,
W72-05071 5B

Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

HASKIN, HAROLD H.
Setting of the American Oyster Related to Environmental Factors and Larval Behavior,
W72-04941 5C

HASLER, ARTHUR D.
Intraseasonal Changes in Caloric Content of Some Freshwater Invertebrates,
W72-04722 2I

HATTINGH, W. H. J.
Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

HAWTHORNE, CHARLES H.
Operation of Conventional Activated Sludge for Maximum Phosphorus Removal,
W72-04978 5D

HEFFERNAN, W. PAUL
The Elimination of Bacteria by the Northern Quahog: Variability in the Response of Individual Animals and the Development of Criteria,
W72-04944 5C

Seasonal Factors Relevant to Coliform Levels in the Northern Quahaug,
W72-04945 5C

HEINRICHS, D. H.
Stand Patterns for Alfalfa-Grass Hay Production in a Dry Climate,
W72-05223 3F

HELLAWELL, J. M.
The Food of the Grayling Thymallus thymallus (L.) of the River Lugg., Herefordshire,
W72-04712 2I

HELM, W. T.
Comparison of Some Species Importance Values and Ordination Techniques Used to Analyse Benthic Invertebrate Communities,
W72-04716 5A

HENDERSON, C.
Expanded Program for Pesticide Monitoring of Fish,
W72-04740 5A

HENDERSON, CROSWELL
Organochlorine Insecticide Residues in Fish-Fall 1969: National Pesticide Monitoring Program,
W72-04982 5A

HENDERSON, H. E.
Dried Poultry Waste as a Protein Source for Feedlot Cattle,
W72-05064 5E

HENDERSON, RICHARD,
The Analysis of Mercury in Urine, Blood, Water, and Air,
W72-05113 5A

HENNING, DANIEL H.
Environmental Policy and Politics: Value and Power Context,
W72-04985 6B

HENRIET, J. P.
Resistivity Soundings in the Condroz (Belgium) With Schlumberger and Dipole Arrays; Application to Limestone Aquifer Evaluation,
W72-04850 2F

HENRIKSSON, KURT
Human Exposure to Mercury from Goosander Eggs Containing Methyl Mercury,
W72-05114 5C

HENRY, R. A.
Combined High Speed Liquid Chromatography and Bioassay for the Evaluation and Analysis of an Organophosphorus Larvacide,
W72-04997 5A

HEPHER, B.
Studies on Carp Nutrition: III. Experiments on the Affect on Fish Yield of Dietary Protein Source and Concentration,
W72-05266 2I

HERGENRADER, GARY L.
Eutrophication of Small Reservoirs in the Great Plains,
W72-04759 5C

Eutrophication of Small Reservoirs in the Great Plains,
W72-04761 5C

HERMAN, R. L.
Oxytetracycline Efficacy as a Pretreatment Against Columnaris and Furunculosis in Coho Salmon,
W72-04930 5C

Oxytetracycline in Fish Culture: A Review,
W72-04933 5C

Oxytetracycline Residues in Different Tissues of Trout,
W72-04928 5C

Oxytetracycline Toxicity to Trout,
W72-04931 5C

HEWLETT, JOHN D.
Comments on the Catchment Experiment to Determine Vegetal Effects on Water Yield,
W72-04954 3B

HIDU, HERBERT
Setting of the American Oyster Related to Environmental Factors and Larval Behavior,
W72-04941 5C

HIGER, A. L.
Organochlorine Insecticide Residues in Everglades National Park and Loxahatchee National Wildlife Refuge, Florida,
W72-04799 5B

HILL, LUCY B.
Ecology of Heterotrophic Aerobic Bacteria of Playa Lakes and Microcosms,
W72-04905 5C

HILL, R. D.
Cost of Reclamation and Mine Drainage Abatement-Elkins Demonstration Project,
W72-05146 5G

HOESTLANDT, HENRI
Effect of 2 Molluscicides (Bayluscide and Frescon) on Fresh-Water Mussels: Dreissena polymorpha Pallas,
W72-05249 5C

HOLMSTROM, B. K.
Floods on Yahara River, Lake Kegonsa Dam to County Line, Dane County, Wisconsin,
W72-04815 4A

HOOD, D. W.
Effect of Upwelling, Mixing, and High Primary Productivity on CO2 Concentrations in Surface Waters of the Bering Sea,
W72-05038 2K

HOPKINS, C. L.
The Annual Temperature Regime of a Small Stream in New Zealand,
W72-04987 2E

HOPKINS, GLEN J.
Polymers in the Filtration of Raw Sludge,
W72-04968 5D

HORNBECK, J. W.
Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

HORNE, FRANCIS R.
Some Effects of Temperature and Oxygen Concentration on Phyllopod Ecology,
W72-04988 5C

HOUCK, CARL P.
Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

HOWARD, JACK
Photographic Method for Surveying Clam Populations,
W72-04750 7B

HRISTOV, G.
Microfertilizing with Mo of Irrigated Alfalfa Grown on Cinnamon Forest Soil in South Bulgaria (In Bulgarian),
W72-05174 3F

HSU, S.-A.
Wind Stress Criteria in Eolian Sand Transport,
W72-05037 2J

HUFFMAN, D. D.
Phosphorus Removal by Luxury Uptake,
W72-05011 5D

HUFFMAN, R. E.
Water Resources Development,
W72-04880 6B

HUMENIK, FRANK J.
Algal-Bacterial Symbiosis for Removal and Conservation of Wastewater Nutrients,
W72-04983 5D

HUNGATE, F. P.
Chondrococcus columnaris Disease of Fishes: Influence of Columbia River Fish Ladders,
W72-04959 5B

HUNTER, J. S.
Stochastic Modeling of Temperature and Flow in Rivers,
W72-05030 2A

HURLEY, P. A.
Hydrometeorology in Precipitation Management,
W72-04866 6B

HUTCHINSON, G. E.
Ianula: An Account of the History and Development of the Lago Di Monterosi, Latium, Italy: XIII. The History of the Lake: A Synthesis,
W72-05209 5C

HUXLEY, P. A.
A Simple Wetness Recorder,
W72-05152 7B

IBBITT, R. P.
Effects of Random Data Errors on the Parameter Values for a Conceptual Model,
W72-05029 7A

ICHIMURA, SHUN-EI
Photosynthetic Properties and Growth of Photosynthetic Sulfur Bacteria in Lakes,
W72-05085 5C

INGLIS, A.
Expanded Program for Pesticide Monitoring of Fish,
W72-04740 5A

INGLIS, ANTHONY
Organochlorine Insecticide Residues in Fish-Fall 1969: National Pesticide Monitoring Program,
W72-04982 5A

INGRAM, J.
The Primacy of our Environment over the Economy,
W72-04887 6B

INOUE, H.
Field Test Results on Diagonal-Flow Type Reversible Pump-Turbines and Generator-Motors for Takane No. 1 Power Station,
W72-04868 8C

JACKSON, HENRY M.
Environmental Policy and the Congress,
W72-05118 6E

JACKSON, M. L.
Cation Exchange Selectivity of Some Clay-Sized Minerals and Soil Materials,
W72-05127 2K

JACKSON, ROY L.
Polymers in the Filtration of Raw Sludge,
W72-04968 5D

JACQUEMART, S.
Mollusca and Cladocera of the 'Ven Gorigemberg', Dystrophic Marshes of the Campine Limbourgeoise,
W72-05212 2L

JAEGER, R. G.
Moisture as a Factor Influencing the Distribution of Two Species of Terrestrial Salamanders,
W72-05154 2I

JAIN, R. K.
Peaking-Station Layouts on Himalayan Rivers,
W72-04875 4A

JAKRLOVA, JANA
Flooded Meadow Communities. An Analysis of Productivity in a Dry Year,
W72-05265 2I

JAMES, W.
A Note on Inexpensive Telemetry of River Sediment Concentrations,
W72-05049 7B

JARVIS, R. G.
Epicuticular Wax in the Stomatal Antechamber of Sitka Spruce and Its Effects on the Diffusion of Water Vapour and Carbon Dioxide,
W72-05241 2D

JAUNARAJS, KARLIS LAIMONIS
Waste Water Treatment Phosphate Removal by Iron Oxide,
W72-05041 5D

JEFFREE, C. E.
Epicuticular Wax in the Stomatal Antechamber of Sitka Spruce and Its Effects on the Diffusion of Water Vapour and Carbon Dioxide,
W72-05241 2D

JEPPSON, R. W.
Finite Difference Solutions of Axisymmetric Infiltration Through Partially Saturated Porous Media,
W72-04805 2G

Inverse Solutions to Three-Dimensional Free Surface Potential Flows,
W72-04808 2F

JERNSTEDT, MAURICE L.
Evaluating Multiple Economic Effects of Forage Development and Management,
W72-05104 4A

JIUSTO, J. E.
Snowfall From Lake-Effect Storms,
W72-04845 2B

JOHN, D. M.
The Distribution and Net Productivity of Sublittoral Populations of Attached Macrophytic Algae in an Estuary on the Atlantic Coast of Spain,
W72-04766 5C

JOHNSON, C. B.
A Comparison of Nitrogen Losses From Urea and Ammonium Nitrate in Surface Runoff Water,
W72-05142 5B

JOHNSON, D. W.
Handling Livestock Waste,
W72-05057 5D

JOHNSON, L. G.
Chlorinated Hydrocarbon Pesticides in Iowa Rivers,
W72-04753 5B

Dieldrin Levels in Fish From Iowa Streams,
W72-04739 5A

JOHNSON, R. P. C.
Epicuticular Wax in the Stomatal Antechamber of Sitka Spruce and Its Effects on the Diffusion of Water Vapour and Carbon Dioxide,
W72-05241 2D

JOHNSON, ROBERT L.
Advanced Organics Removal by Pulsed Adsorption Beds,
W72-05005 5D

JOHNSON, W. L.
Expanded Program for Pesticide Monitoring of Fish,
W72-04740 5A

JOHNSON, WENDELL C.
Growth Patterns of Irrigated Sugarbeet Roots and Tops,
W72-04915 3F

JOHNSON, WENDELL L.
Organochlorine Insecticide Residues in Fish-Fall 1969: National Pesticide Monitoring Program,
W72-04982 5A

JONICA, EDMUND
Th Role of Animals in Earth-Surface Modeling Processes,
W72-04876 2G

JOUN, Y. P.
Information Requirement for Socio-Ecological Models,
W72-05119 6A

JUNGERMANN, K.
Energy Production in Anaerobic Organisms,
W72-05018 5D

JURINAK, J. J.
Cation Adsorption in One-Dimensional Flow Through Soils: A Numerical Solution,
W72-05031 2G

KACHURIN, B. S.
Long-Term Water-Quality Characteristics of the Bratsk Reservoir and Forecast of Organic Matter Accumulation (Mnogoletnyaya kharakteristika formirovaniya kachestva vody i prognoz nakopleniya organicheskogo veshchestva v Bratskom vodok hranilishche),
W72-04859 5C

KACZKA, EUGENE E.
A Computerized Educational Program for the Application of the Management Sciences to Water Resource Management,
W72-05088 7C

KAESLER, ROGER L.
Cluster Analysis of Non-Insect Macro-invertebrates of the Upper Potomac River,
W72-05134 5C

KAHANONWITZ, A.
Thermal Mapping of Selected Sites in the Lake Kinneret Region,
W72-04811 7B

KALBACK, M.
The Growth of Pores in Graphitized Carbon Reacted with Carbon Dioxide,
W72-04704 5D

KAPLAN, M. L.
Snowfall From Lake-Effect Storms,
W72-04845 2B

KARASEK, F. W.
ESCA--The New Spectroscopy,
W72-05051 2K

KARPANEN, EEVA
Human Exposure to Mercury from Goosander Eggs Containing Methyl Mercury,
W72-05114 5C

KAUER, JAMES C.
Chemical Stimulants Affecting Larval Settlement in the American Oyster,
W72-04943 5C

KAUL, R.
Relations between Water Status, Leaf Temperature Stomatal Aperture, and Productivity of Some Wheat Varieties (In German),
W72-05185 3F

KAUTTER, D. A.
Detection of Clostridium Botulinum Type E in Smoked Fish,
W72-04745 5A

KAWAI, AKIRA,
Microbiological Studies on Nigrogen Cycle in Aquatic Environments: I. Effect of Oxygen Tension on Microflora and Balance of Nitrogeneous Compounds in the Experimental Aquarium.
W72-05164 5C

KAWANABE, HIROYA
Social Behaviour and Production of Ayu-Fish in the River Ukawa Between 1955 and 1969, with Reference to the Stability of its Territoriality (In Japanese),
W72-05176 2I

KECK, RICHARD
Chemical Stimulants Affecting Larval Settlement in the American Oyster,
W72-04943 5C

KELLER, WESLEY
Limits on Western Range Forage Production: Water or Man,
W72-05230 4A

KELLEY, J. J.
Effect of Upwelling, Mixing, and High Primary Productivity on CO2 Concentrations in Surface Waters of the Bering Sea,
W72-05038 2K

KELLNER, E.
The Variability of Seedling Drought Tolerance in Some Cocksfoot (Dactylis glomerata L.) Varieties, (In Rumanian),
W72-05187 3F

KEMP, A. L. W.
Organic Carbon and Nitrogen in the Surface Sediments of Lakes Ontario, Erie and Huron,
W72-05003 2H

KEMPTON, A. G.
Use of 14C-Glucose to Study Substrate Removal by Activated Sludge,
W72-04970 5D

KENNEDY, FRANK W.
Evaluation Criteria for Granular Activated Carbons,
W72-04977 5D

KERAMBRUN, P.
Ecological Conditions Caused by Evaporation in the Ponds of Camargue,
W72-05007 2D

KERHIN, R. T.
Coastal Sedimentation of Southeastern Lake Michigan, Field Trip Guidebook,
W72-04807 2J

KESNER, W. D.
Ecological and Physiological Implications of Greenbelt Irrigation,
W72-04898 6G

KHADR, M. F. A.
Utilization of Water Hyacinth as an Organic Manure with Special Reference to Water-Borne Helminths,
W72-05115 5F

KHAN, ASIF A.
Primary Production in a Tropical Fish Pond at Aligarh, India,
W72-05000 5C

KHAN, JAMIL A.
Nutrient Regeneration From Dead Freshwater Plankton,
W72-05219 5C

KHAN, N. Y.
Intraspecific Variations and Postglacial Distribution of Lake Char (Salvelinus namaycush),
W72-04913 2H

KHARE, J. D.
Numerical Modeling of Unsaturated Groundwater Flow Including Effects of Evapotranspiration,
W72-05089 2G

KHVATOVA, L. A.
Possibility of Reduction of Plant Transpiration During Summer Transplantations by Means of Antitranspirants, (In Russian),
W72-05253 2D

KIBAL'CHICH, I. A.
Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

KILCHER, M. R.
Stand Patterns for Alfalfa-Grass Hay Production in a Dry Climate,
W72-05223 3F

KIMBALL, T. L.
Water Resources Planning,
W72-04885 6B

KISHI, H.
Study on the New Strain of the Pathogenic 'Vibrio' Isolated from Freshwater Fishes,
W72-04720 5A

KISIEL, C. C.
Space-Time Sampling of Ecological Systems,
W72-04779 6A

KITCHING, R. L.
A Core Sampler for Semi-Fluid Substrates,
W72-05008 7B

KLEINENDORST, D.
The Measurement of Small Soil Displacements on a Dutch Hillslope,
W72-05040 2G

KLEINSTEIN, G.
Analysis of Turbulent Pipe Flow,
W72-05050 8B

KLOCK, JOHN W.
Survival of Coliform Bacteria in Wastewater Treatment Lagoons,
W72-04976 5D

KNECT, GEORGE N.
The Effect of Relative Humidity on Growth, Yield, and Water Consumption of Bean Plants,
W72-04926 3F

KNOPPEL, H. A.
Ecology of Freshwater Fishes in Amazonia: Present State of Knowledge and Future Problems, (In German),
W72-05277 2I

KOBAYASHI, MAKOTO
An Investigation on Slope Erosion by Meltwater of Snow-Patches in Mt. Gassan, (In Japanese),
W72-05218 2J

KOLIPINSKI, M. C.
Organochlorine Insecticide Residues in Everglades National Park and Loxahatchee National Wildlife Refuge, Florida,
W72-04799 5B

KOSTAREVA, G. V.
Strontium-90, Strontium and Calcium in some Aquatic Organisms from the Sea of Okhotsk, (In Russian),
W72-04999 5A

KOTZE, J. P.
Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

KOVACS, G.
Seepage Through Saturated and Unsaturated Layers,
W72-05045 2G

KOWN, BONG T.
The Effects of Column Height and Diameter on the Effectiveness of a Continuous Bubble Fractionation System,
W72-04921 5G

KOZHOVA, O. M.
Aquatic Bacteria in the Bratsk Reservoir in 1965 (Bakterioplankton Bratskogo vodokhranilishcha v 1965 g.),
W72-04856 2H

Formation of Phytoplankton in the Bratsk Reservoir (Formirovaniye fitoplanktona Bratskogo vodokhranilishcha),
W72-04855 5C

KOZLOWSKI, THEODORE T.
The Response of Transpiration Resistance to Leaf Temperature as a Desiccation Resistance Mechanism in Tree Seedlings,
W72-05244 2D

KRAMER, R. H.
Factors Influencing Scope for Activity and Active and Standard Metabolism of Rainbow Trout (Salmo gairdneri),
W72-04958 5C

KRAUSE, LEONARD A.
The Analysis of Mercury in Urine, Blood, Water, and Air,
W72-05113 5A

KRAVETS, V. V.
Utilization of Algae Culture for Purification of Wastes of Wool-Washing Installations in Experimental Biological Ponds, (In Russian),
W72-05125 5D

KRCMA, RICHARD F.
Migration of Juvenile Salmon and Trout into Brownlee Reservoir, 1962-65,
W72-04771 2H

KRUSE, C. W.
Amoebic Cysticidal Properties of Halogens in Water,
W72-04746 5F

KUHN, A. L.
A Colorimetric Method for Ammonia in Natural Waters,
W72-04964 5A

KUNISHI, HARRY M.
Phosphate Equilibria on Stream Sediment and Soil in a Watershed Draining an Agricultural Region,
W72-04774 5C

KUPYROV, V. N.
The Possibility of Contaminating Underground Waters with Mononitrotoluene,
W72-05237 5B

KURTZ, D. A.
Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

KUZ'MYN, V. I.
Utilization of Algae Culture for Purification of Wastes of Wool-Washing Installations in Experimental Biological Ponds, (In Russian),
W72-05125 5D

LABOURG, P. J.
Amphipods of the Genus Gammarus in the Arcachon Basin, (In French),
W72-05276 2I

LACKIE, N. F.
Advances in the Continuous Culture of Planktonic Copepods,
W72-04900 5A

LAI, S.-H.
Cation Adsorption in One-Dimensional Flow Through Soils: A Numerical Solution,
W72-05031 2G

LAMONDS, A. G.
Hydrologic Data for Horseshoe Lake, Arkansas, and Vicinity,
W72-04822 7C

LANGE, R. T.
Lichen Populations on Arid Soil Crusts Around Sheep Watering Places in South Australia,
W72-04790 2I

LAUDELOUT, HENRI
The Effect of Water Activity on Ion Exchange Selectivity in Clays,
W72-05135 2G

LAWRENCE, C. L.
Floods on Yahara River, Lake Kegonsa Dam to County Line, Dane County, Wisconsin,
W72-04815 4A

LEAF, ALBERT L.
Annual Soil Moisture-Temperature Patterns as Influenced by Irrigation,
W72-05137 2G

LEBLANC, R. A.
Descriptions and Chemical Analyses for Selected Wells in the Dos Palos-Kettleman City area, San Joaquin Valley, California,
W72-04843 2K

LEE, G. F.
Denitrification as a Nitrogen Sink in Lake Mendota, Wisconsin,
W72-05130 5B

Method For the Storage of Samples For Dissolved Gas Analyses,
W72-04729 5A

Selenium in Lake Sediments - Analytical Procedure and Preliminary Results,
W72-04733 5A

LEE, G. FRED
Forms of Inorganic Nitrogen in Domestic Wastewater,
W72-04981 5A

LELOUP, E.
Mollusca and Cladocera of the 'Ven Gorigemberg', Dystrophic Marshes of the Campine Limbourgeoise,
W72-05212 2L

LEMON, E.
Carbon Dioxide Exchange of a Tropical Rain Forest: Part II,
W72-05168 2B

LEONARD, A. B.
Farmdalian Lake Deposits and Faunas in Northern Illinois,
W72-04834 2H

LEONARD, RAYMOND E.
Annual Soil Moisture-Temperature Patterns as Influenced by Irrigation,
W72-05137 2G

LEVI, DINO
Observations on the Plankton of the Port of Civitavecchia, (In Italian),
W72-05196 5C

LEVINSON, A. A.
An Improved Dianthrimide Technique for the Determination of Boron in River Waters,
W72-05109 5A

LI, Y. -H.
Geochemical Mass Balance Among Lithosphere, Hydrosphere, and Atmosphere,
W72-04814 2K

LICHTENBERG, JAMES J.
Persistence of Pesticides in River Water,
W72-04922 5B

LIEBREGHTS, F.
Research on the Level of Chlorinity of the Interstitial Water in the Bed of the Slack River, (In Dutch),
W72-05211 2L

LIKENS, G. E.
Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

LILLY, T. JR
Detection of Clostridium Botulinum Type E in Smoked Fish,
W72-04745 5A

LINSTEDT, K. DANIEL
Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

LINSTROM, E. S.
Isolation and Counting of Athiorhodaceae with Membrane Filters,
W72-04743 5A

LISK, DONALD J.
Rapid Determination of Mercury in Fish,
W72-04948 5A

LISKOWITZ, J. W.
An Empirical Method for Determining the Concentration of Solids in Suspension,
W7204731 5A

LITTLE, ANGELA C.
Analysis of Coffee, Tea and Artificially Flavored Drinks Prepared from Mineralized Waters,
W72-04782 7B

LOEHR, RAYMOND C.
Alternatives for the Treatment and Disposal of Animal Wastes,
W72-04937 5D

LOFGREN, B. E.
Estimated Subsidence in the Raymond Basin, Los Angeles County, California, for a Postulated Water-Level Lowering, 1970-2020,
W72-04823 4B

LOFTING, E. M.
An Intersectoral Programming Model for the Management of the Waste Water Economy of the San Francisco Bay Region,
W72-04780 5B

LONGBOTTOM, J. E.
Determination of Nitrilotriacetic Acid by High-Speed Ion Exchange Chromatography,
W72-04901 5A

LONGERICH, L. L.
Effect of Upwelling, Mixing, and High Primary Productivity on CO2 Concentrations in Surface Waters of the Bering Sea,
W72-05038 2K

LORENZONI, ANNA MARIA
Ecological Considerations of the Animal Population of the Lagabrun Peat-Bog,
W72-05181 2H

Ecological Considerations of the Animal Population of the Santo Lake of Cembra,
W72-05205 2H

LOTSE, E. G.
Cation Exchange Selectivity of Some Clay-Sized Minerals and Soil Materials,
W72-05127 2K

LUDINGTON, D. C.
Gases and Odors from Undiluted and Diluted Chicken Manure,
W72-05071 5B

Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

LUFEROV, V. P.
The Role of Light in the Distribution of Epibiontic Chironomid Larvae in Lake Sevan, (In Russian),
W72-05157 2H

LUND, J. W. G.
An Artificial Alteration of the Seasonal Cycle of the Plankton Diatom Melosira Italica Subsp Subarctica in an English Lake,
W72-04765 5C

LUTHIN, J. N.
The Amelioration of Gley and Pseudogley Soils,
W72-04899 2G

MACHIN, JOHN
The Study of Evaporation from Small Surfaces by the Direct Measurement of Water Vapor Pressure Gradients,
W72-04925 2D

MACK, F. K.
Progress Report on the Analog Model Study of the Magothy Aquifer in the Annapolis, Maryland Area.
W72-04840 4B

MACKIE, G. L.
A Quantitative Sampler for Aquatic Phytomacrofauna,
W72-04710 5A

MADDOCK, T. III
Algebraic Technological Function from a Simulation Model,
W72-05034 6A

MADSEN, O. S.
On the Generation of Long Waves,
W72-05039 2E

MAGNUSON, L. M.
Effects of Urbanization on Storm Water Runoff Quality: A Limited Experiment, Naismith Ditch, Lawrence, Kansas,
W72-05035 4C

MALANEY, GEORGE W.
Dual Substrate Utilization by Activated Sludge Microflora,
W72-04990 5D

MALICK, JAMES G.
Population Dynamics of Selected Zooplankton in Three Oligotrophic Oregon Lakes,
W72-04763 5C

MALONE, T. C.
Diurnal Rhythms in Netplankton and Nannoplankton Assimilation Ratios,
W72-04770 5C

MALY, JOSEF
Influence of Temperature on Anaerobic Digestion,
W72-05010 5D

MAMONTOV, A. M.
Fish Population and Distribution in the Oka River Section of the Bratsk Reservoir (Razmeshcheniye i chislennost' ryb v Okinskoy chasti Bratskogo vodokhranilishcha),
W72-04858 2H

MAMONTOVA, L. M.
Aquatic Bacteria in the Bratsk Reservoir in 1965 (Bakterioplankton Bratskogo vodokhranilishcha v 1965 g.),
W72-04856 2H

MANDAL, T. C.
The Effects of Electrokinetics Upon Incrustation in Water Wells,
W72-04870 8A

MANNERING, J. V.
A Comparison of Nitrogen Losses From Urea and Ammonium Nitrate in Surface Runoff Water,
W72-05142 5B

MARANI, A.
Effects of Soil Moisture Stress on Two Varieties of Upland Cotton in Israel: I. The Coastal Plain Region,
W72-05179 3F

Effects of Soil Moisture Stress on Two Varieties of Upland Cotton in Israel: II. The Northern Negev Region,
W72-05180 3F

MARCUZZI, GIORGIO
Ecological Considerations of the Animal Population of the Lagabrun Peat-Bog,
W72-05181 2H

Ecological Considerations of the Animal Population of the Santo Lake of Cembra,
W72-05205 2H

MARFARITORA, FIORENZA
Ianula: An Account of the History and Development of the Lago Di Monterosi, Latium, Italy: IV. Present Ecological Conditions in the Lake,
W72-05208 5C

MARTENS, DENNIS W.
Toxicity and Oxygen Demand of Decaying Bark,
W72-04957 5C

MARTYNYUK, V. Z.
Establishing Hygienic Standards for the New Combined Anti-Monocot Herbicide 50/30 Celatox in Inland Waters,
W72-05248 5C

MASINOVA, L.
Biological and Bacteriological Evaluation of Pilot Plant Artificial Recharge Experiments,
W72-05143 4B

MASSENGALE, M. A.
Effect of Growth Regulator and Anti-Transpirant Chemicals on Water Requirement and Growth Components of Alfalfa (Medicago sativa L.),
W72-05232 3F

MATHEWS, C. P.
Contribution of Young Fish to Total Production of Fish in the River Thames Near Reading,
W72-04721 2I

MATSUMURA, FUMIO
Phenylmercuric Acetate: Metabolic Conversion by Microorganisms,
W72-05138 5C

MATTSON, JAMES S.
Evaluation Criteria for Granular Activated Carbons,
W72-04977 5D

MAULBETSCH, JOHN S.
A Survey of Alternate Methods for Cooling Condenser Discharge Water, Total Community Considerations in the Utilization of Rejected Heat,
W72-04830 5D

MAURER, DON
Chemical Stimulants Affecting Larval Settlement in the American Oyster,
W72-04943 5C

Holding and Spawning Delaware Bay Oysters (Crassostrea virginica) Out of Season: II. Temperature Requirements for Maturation of Gonads,
W72-04942 5C

MAYO, R. I.
Floods of July 4-8, 1969 in North-Central Ohio,
W72-04852 2E

MC LACHLAN, S. M.
The Rate of Nutrient Release from Grass and Dung Following Immersion in Lake Water,
W72-05020 2H

MCADOO, G. D.
Records of Wells, Drillers' Logs, and Chemical Analysis of Ground Water in Galveston County, Texas 1952-1970,
W72-04795 4B

MCCARTY, PERRY L.
Effects of Carbonate and Magnesium on Calcium Phosphate Precipitation,
W72-04949 5D

MCCAULEY, DONALD
Operation of Conventional Activated Sludge for Maximum Phosphorus Removal,
W72-04978 5D

MCCOLL, J. G.
Properties of Some Natural Waters in a Tropical Wet Forest of Costa Rica,
W72-05194 2K

MCCONNELL, GRANT
The Environmental Movement: Ambiguities and Meanings,
W72-05021 6B

MCDERMOTT, G. N.
Industrial Spill Control and Pollution Incident Prevention,
W72-05017 5G

MCDERMOTT, JAMES H.
The Home Groundwater Supply Picture as We See It,
W72-04950 5F

MCDONALD, G. T.
Agricultural Flood Damage Assessment: A Review and Investigation of a Simulation Method,
W72-04877 6F

MCERLEAN, A. J.
Photographic Method for Surveying Clam Populations,
W72-04750 7B

MCGAUHEY, P. H.
Alternatives in Water Management,
W72-04893 6B

MCKONE, COLIN
Rapid Determination of Mercury in Fish,
W72-04948 5A

MCMICHAEL, F. C.
Stochastic Modeling of Temperature and Flow in Rivers,
W72-05030 2A

MCNABB, J. F.
Probable Impact of NTA on Ground Water,
W72-04800 5B

MCNEIL, W. N.
Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

MCNOWN, J. S.
Runoff from Impervious Surfaces,
W72-04844 4C

MEEUWIG, RICHARD O.
Sheet Erosion on Intermountain Summer Ranges,
W72-04777 2J

MELBINGER, N. R.
Toxic Effects of Ammonia Nitrogen in High-Rate Digestion,
W72-05015 5D

MENSHUTKIN, V. V.
Modelling of Populations and Communities of Aquatic Animals on Digital Computers (In Russian),
W72-05175 2H

MERON, AARON
Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

METWALLY, S. Y.
The Influence of Soil Moisture on Phosphorus Uptake by Corn and on the Efficiency of Added Superphosphate,
W72-05217 3F

MEYERSON, A. LEE
Glacial Lake Passaic: Palynological Evidence for Draining of the Great Swamp Stage,
W72-05200 2H

MGZHEGOTSKII, M. I.
Establishing Hygienic Standards for the New Combined Anti-Monocot Herbicide 50/30 Celatox in Inland Waters,
W72-05248 5C

MIKESOVA, V.
Virological Surveys of the Presence of Enteroviruses in Waste Water: I. Incidence of Polio-viruses in Prague at the End of 1963 and in 1969, (In Czech),
W72-05226 5B

MILBRINK, G.
A Simplified Tube Bottom Sampler,
W72-04715 7B

MILBURY, WILLIAM F.
Operation of Conventional Activated Sludge for Maximum Phosphorus Removal,
W72-04978 5D

MILLER, EDWARD R.
Considerations for Conventional Trout Hatchery Design and Construction in Pennsylvania,
W72-04934 8I

MILLSON, M. F.
Hydrogen Isotope Ratios in a Recycling System,
W72-04967 5D

MINCKLEY, W. L.
Some Aspects of Biology of the Longfin Dace, a Cyprinid Fish Characteristic of Streams in the Sonoran Desert,
W72-04723 2I

MINER, J. RONALD
Farm Animal-Waste Management,
W72-04908 5G

MITCHELL, CARL J.
The Microclimate of Simulated Burrows of Bandicota bengalensis (G and H.) in Calcutta, India (Rodentia:Muridae),
W72-05273 2I

MITSUHASHI, S.
Study on the New Strain of the Pathogenic 'Vibrio' Isolated from Freshwater Fishes,
W72-04720 5A

MITTRA, B. N.
Effects of Depth of Submergence, Fertilization and Cultivation on Water Requirement and Yield of Rice,
W72-05190 3F

MOE, P. G.
A Comparison of Nitrogen Losses From Urea and Ammonium Nitrate in Surface Runoff Water,
W72-05142 5B

MOLZ, FRED J.
Interaction of Water Uptake and Root Distribution,
W72-05242 3F

MOORE, C. V.
Alternative Water Policies for an Arid Region,
W72-04892 6B

MOORE, DONALD
Setting, Growth and Mortality of Crassostrea virginica in a Natural Marsh and a Marsh Altered by a Housing Development,
W72-04940 5C

MORAVCOVA, A.
Biological and Bacteriological Evaluation of Pilot Plant Artificial Recharge Experiments,
W72-05143 4B

MORDUKHAI-BOLTOVSKOI, F. D.
Caspian Fauna in the Black Sea (Beyond the Limits of Freshwater Regions), (In Russian),
W72-05162 2L

MOREL-SEYTOUX, H. J.
Detection of a Change in Runoff by an Analysis of Daily Flows,
W-72 04846 2A

MORRIS, R. L.
Chlorinated Hydrocarbon Pesticides in Iowa Rivers,
W72-04753 5B

Dieldrin Levels in Fish From Iowa Streams,
W72-04739 5A

MOSIEJ, TERESA
Influence of Soil Moisture and NPK Level Upon the Growth and Yield of the Annual Caraway (Carum carvi L. f. Annua.), (In Polish),
W72-05250 3F

MUIR, K. S.
Water Chemistry of the Santa Clara Valley, California,
W72-04835 2K

MULBARGER, M. C.
Nitrification and Denitrification in Activated Sludge Systems,
W72-05019 5D

Phosphorus Removal by Luxury Uptake,
W72-05011 5D

MULHERN, BERNARD M.
Semiquantitative Determination of Polychlorinated Biphenyls in Tissue Samples by Thin Layer Chromatography,
W72-04946 5A

MULLER, L.
Carbon Dioxide Exchange of a Tropical Rain Forest: Part II,
W72-05168 2B

MURPHEY, F. J.
Combined High Speed Liquid Chromatography and Bioassay for the Evaluation and Analysis of an Organophosphorus Larvacide,
W72-04997 5A

MURPHY, M. C.
Phosphorus Removal by Luxury Uptake,
W72-05011 5D

MYERS, V. I.
Reflectance and Internal Structure of Cotton Leaves, Gossypium Hirsutum L.,
W72-05105 3F

NAFTEL, W. L.
Records of Wells, Drillers' Logs, and Chemical Analysis of Ground Water in Galveston County, Texas 1952-1970,
W72-04795 4B

NAGANUMA, S.
Single-Stage, 500 M High-Head Reversible Pump-Turbines and Generator-Motors for Numappara Power Station,
W72-04867 8C

NAMKEN, L. N.
Water Stress and Stem Radial Contraction of Cotton Plants (Gossypium hirsutum L.) Under Field Conditions,
W72-04961 3F

NEFF, M.
The Metabolizeable Energy Value of Dried Poultry Waste,
W72-05065 5E

NESBITT, J. B.
Phosphorus Removal - The State of the Art,
W72-05131 5D

NEWLIN, KIMREY D.
The Economic Feasibility of Treating Textile Wastes in Municipal Systems,
W72-04989 5D

NEWMAN, MARTIN W.
A Parasite and Disease Survey of Connecticut Oysters,
W72-04939 5C

NICOLLIER, L. I. M.
Action of Mineral Waters on Mineral Metabolism in Ruminants: II. Phosphorus,
W72-05111 5F

NIEUWENHUIS, J. D.
The Measurement of Small Soil Displacements on a Dutch Hillslope,
W72-05040 2G

NOOTER, K.
Research on the Level of Chlorinity of the Interstitial Water in the Bed of the Slack River, (In Dutch),
W72-05211 2L

NYANISHKENE, V. M. B.
Quantitative Characterization of the Means of Strontium-90 Intake into the Body of Gastropods, (In Russian),
W72-05227 5A

NYMAN, DAG
Human Exposure to Mercury from Goosander Eggs Containing Methyl Mercury,
W72-05114 5C

OBERLANDER, T. M.
Morphogenesis of Granitic Boulder Slopes in the Mojave Desert, California,
W72-04813 2J

OBLOCINSCHI, A.
A Study of the Variation of Water Level and Mineralization of the Ground Water in the Danube Drainage Area 'Boianu-Sticlenau' (In Rumanian),
W72-05169 5C

O'CONNOR, JOHN T.
Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

O'LEARY, JAMES W.
The Effect of Relative Humidity on Growth, Yield, and Water Consumption of Bean Plants,
W72-04926 3F

OLLIER, C. D.
Causes of Spheroidal Weathering,
W72-04794 2J

OLMON, JANET
Daylight Incubator Estimates of Primary Production in the Mouth of the Patuxent River, Maryland,
W72-04904 2L

O'REAGAN, R.
Laser Holography and Interferometry in Materials Research,
W72-04873 7B

OSEID, DONAVON M.
Survival and Hatching of Walleye Eggs at Various Dissolved Oxygen Levels,
W72-04935 5C

OSWALD, WILLIAM J.
Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

OTT, ARTHUR N.
Composition of Surface Waters of New Jersey in Relation to Soil Series: II. Waters of the South Branch: Raritan River, Stony Brook, Neshanic River and Assumpink Creek,
W72-05198 5A

OTTERMAN, J.
Thermal Mapping of Selected Sites in the Lake Kinneret Region,
W72-04811 7B

OTTO, ROBERT G.
Effects of Salinity on the Survival and Growth of Pre-Smolt Coho Salmon (Oncorhynchus kisutch),
W72-04775 8I

PAHL, R. E.
Urban Social Theory and Research,
W72-05121 6B

PAIST, M.
A Convenient Method for Isolation of Salmonellae from Sewage and Contaminated Sea Water,
W72-04919 5D

PALAMAR-MORDVYNTSEVA, H. M.
Utilization of Algae Culture for Purification of Wastes of Wool-Washing Installations in Experimental Biological Ponds, (In Russian),
W72-05125 5D

PALYANYCHKA, L. F.
Utilization of Algae Culture for Purification of Wastes of Wool-Washing Installations in Experimental Biological Ponds, (In Russian),
W72-05125 5D

PANDE, H. K.
Effects of Depth of Submergence, Fertilization and Cultivation on Water Requirement and Yield of Rice,
W72-05190 3F

PANGBORN, ROSE MARIE
Analysis of Coffee, Tea and Artificially Flavored Drinks Prepared from Mineralized Waters,
W72-04782 7B

PARK, DONN L.
Distribution and Movement of Juvenile Salmon in Brownlee Reservoir, 1962-65,
W72-04768 2H

PARK, P. KILHO
Nutrients and Carbon Dioxide in the Columbia River,
W72-04974 5B

PARKER, G. G. JR
Municipal, Industrial, and Irrigation Water Use in Washington, 1970,
W72-04816 6D

PASCAL, A. H.
Where Will All the People Go. How Much Will They Dump When They Get There -- Population Distribution, Environmental Damage, and the Quality of Life,
W72-05123 6B

PASCUAL, EMILIO
A Contribution to the Knowledge of Reproduction in the Oyster, Crassostrea angulata (LMK.), in the Estuary of the Guadalquivir, (In Spanish),
W72-05257 2L

PASSIOURA, J. B.
The Analysis of Experiments on Hydrodynamic Dispersion,
W72-05128 2G

Gravity Segregation During Miscible Displacement Experiments,
W72-05126 2G

Hydrodynamic Dispersion in Aggregated Media: 1. Theory,
W72-05122 2G

PATTACINI, S. C.
Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides,
W72-04738 5A

PAUNET, M.
A Study of the Variation of Water Level and Mineralization of the Ground Water in the Danube Drainage Area 'Boianu-Sticlenau' (In Rumanian),
W72-05169 5C

PEEP, M.
The Chesapeake Bay Institute Wave Follower--Part II,
W72-04818 7B

PENMAN, H. L.
Woburn Irrigation, 1960-8: V. Results for Leys,
W72-04910 3F

Woburn Irrigation, 1960-8: VI. Results for Rotation Crops,
W72-04911 3F

PERKINS, F. E.
A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

PETERS, J. A.
Water Conservation by Reclamation and Recharge,
W72-05140 5D

PHELPS, L. BARRY
Dredge-Tailing Agriculture on the Rio Nechi, Colombia,
W72-05182 3F

PHILIPP, A. H.
Disposal of Insulation Board Mill Effluent by Land Irrigation,
W72-05002 5D

PHILLIPS, R. E.
Influence of No-Tillage on Soil Moisture,
W72-05155 2G

PHILLIPS, S. H.
Influence of No-Tillage on Soil Moisture,
W72-05155 2G

PHLEGER, FRED B.
A Modern Evaporite Deposit in Mexico,
W72-05161 2L

PICCOLO, R. A.
Coastal Sedimentation of Southeastern Lake Michigan, Field Trip Guidebook,
W72-04807 2J

PIERCE, R. S.
Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

PILLAI, NARAYANA N.
Design and Operation of an Extended Aeration Plant,
W72-04973 5D

PINDER, G. F.
Application of Galerkin's Procedure to Aquifer Analysis,
W72-05032 2F

PINKSTER, S.
Amphipods of the Genus Gammarus in the Arcachon Basin, (In French),
W72-05276 2I

PLESA, I.
A Study of the Variation of Water Level and Mineralization of the Ground Water in the Danube Drainage Area 'Boianu-Sticlenau' (In Rumanian),
W72-05169 5C

POKORNA, L.
Virological Surveys of the Presence of Enteroviruses in Waste Water: I. Incidence of Polio-viruses in Prague at the End of 1963 and in 1969, (In Czech),
W72-05226 5B

POLIKARPOV, G. G.
Quantitative Characterization of the Means of Strontium-90 Intake into the Body of Gastropods, (In Russian),
W72-05227 5A

POLIN, D.
The Metabolizeable Energy Value of Dried Poultry Waste,
W72-05065 5E

PORRO, T. J.
Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides,
W72-04738 5A

POTOCANAC, JOSIP
Results of Complex Investigations Relating to the Influence of Soil Moisture, Fertilizing with N, Sowing Density and Year, Singly and Interacting, in Wheat Production (In Croatian),
W72-05177 3F

POWELL, TOM G.
Boom Applicator for Aquatic Herbicides,
W72-04707 8I

PRATHER, K. V.
Effects of Siltation and Coarser Sediments on Distribution and Abundance of Stream-Inhabiting Insects,
W72-05024 5C

PRATT, G. L.
Handling Livestock Waste,
W72-05057 5D

PRICE, KENT S. JR
Holding and Spawning Delaware Bay Oysters (Crassostrea virginica) Out of Season: II. Temperature Requirements for Maturation of Gonads,
W72-04942 5C

PRINCE, RALPH P.
Design and Operation of an Extended Aeration Plant,
W72-04973 5D

QADRI, S. U.
Intraspecific Variations and Postglacial Distribution of Lake Char (Salvelinus namaycush),
W72-04913 2H

A Quantitative Sampler for Aquatic Phytomacrofauna,
W72-04710 5A

QASHU, H. K.
Space-Time Sampling of Ecological Systems,
W72-04779 6A

QUENNELL, SHELIA
Some Quantitative Algal Studies of the River Thames,
W72-04963 5C

RALEIGH, ROBERT F.
Distribution and Movement of Juvenile Salmon in Brownlee Reservoir, 1962-65,
W72-04768 2H

Migration of Juvenile Salmon and Trout into Brownlee Reservoir, 1962-65,
W72-04771 2H

RAMIREZ, L. E.
Development of a Procedure for Determining Spacial and Time Variations of Precipitation in Venezuela,
W72-04804 2B

RASMUSSEN, P. E.
Phosphorus Fertilization of Hops,
W72-05148 5B

RAWLINS, S. L.
In Situ Measurement of Soil and Plant Leaf Water Potential,
W72-05136 2D

RAZUVANOV, V. G.
Seasonal Meteorological Conditions in the Region of the Bratsk Reservoir (Sezonnyye meteorologicheskiye usloviya v rayone Bratskogo vodokhranilishcha),
W72-04854 2H

REGIER, L. W.
Pigmentation of Brook Trout (Salvelinus fontinalis) by Feeding Dried Crustacean Waste,
W72-04756 2I

REICHEL, WILLIAM L.
Semiquantitative Determination of Polychlorinated Biphenyls in Tissue Samples by Thin Layer Chromatography,
W72-04946 5A

REID, BARRY H.
Nutrients and Carbon Dioxide in the Columbia River,
W72-04974 5B

REPLOGLE, J. A.
Critical-Depth Flumes for Determining Flow in Canals and Natural Channels,
W72-04871 8B

REYNOLDS, G. W.
Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

RICHARDSON, A.
Residues of Polychlorobiphenyls in Biological Samples,
W72-04754 5A

RICHARDSON, E. V.
Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

Streamflow, Groundwater and Ground Response Data--Volume II, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05096 7C

RICKLIS, S.
A Convenient Method for Isolation of Salmonellae from Sewage and Contaminated Sea Water,
W72-04919 5D

RIDLEY, ESTHER J.
Anatomical Changes in the Shoot Tip of Wheat After Exposure to Drought Stress,
W72-05153 3F

RIMER, ALAN E.
Microstraining Paper Mill Wastewater,
W72-04996 5D

RIZK, S. G.
Utilization of Water Hyacinth as an Organic Manure with Special Reference to Water-Borne Helminths,
W72-05115 5F

ROBARTS, R. D.
Use of 14C-Glucose to Study Substrate Removal by Activated Sludge,
W72-04970 5D

ROBEYNS, JOSE
The Effect of Water Activity on Ion Exchange Selectivity in Clays,
W72-05135 2G

ROBINSON, J.
Residues of Polychlorobiphenyls in Biological Samples,
W72-04754 5A

ROBINSON, R. A.
Potassium Fluoride - A Reference Standard for Fluoride Ion Activity,
W72-04741 5A

ROBINTON, ELIZABETH D.
The Mill River and Its Floodplain in Northampton and Williamsburg, Mass.: A Study of the Vascular Plant Flora, Vegetation, and the Presence of the Bacterial Family Pseudomonadaceae in Relation to Patterns of Land Us e,
W72-05092 5C

ROGERS, HUGO H. JR
Nutrient Removal by Waterhyacinth,
W72-04776 5C

ROGERS, R. W.
Lichen Populations on Arid Soil Crusts Around Sheep Watering Places in South Australia,
W72-04790 2I

ROPES, JOHN W.
Percentage of Solids and Length-Weight Relationship of the Ocean Quahog,
W72-04744 2I

RORABAUGH, M. I.
Hydrology of Hungry Horse Reservoir, Northwestern Montana,
W72-04821 4A

ROSE, BENJAMIN FRANKLIN JR
Auxiliary Sewage Storage System for Temporarily Storing Sewage,
W72-05022 5D

ROSE, C. W.
A Physical Analysis of Diurnal Temperature Regimes in Clear and Turbid Water Layers: A Problem in Rice Culture,
W72-05144 2D

ROSE, D. A.
The Analysis of Experiments on Hydrodynamic Dispersion,
W72-05128 2G

Gravity Segregation During Miscible Displacement Experiments,
W72-05126 2G

ROSE, J. L.
Water Conservation by Reclamation and Recharge,
W72-05140 5D

ROSE, V. C.
Nuclear Energy for a New Town,
W72-05091 6G

ROSENBERG, M.
Problems Raised by the Application of Stochastic Relations to Hydrologic Variables and Means of Their Solution (Problemes souleves par l' application des relations stochastiques aux variables hydrologiques et moyens de les resoudre),
W72-04847 2A

ROSENGREN, N. J.
The Disappearing Mitchell Dekta,
W72-05156 4D

ROSSI, G.
Cartridge Magnetic Tape Incremental Recorder for Hydro-Meteorological Data Acquisition,
W72-04848 7A

ROSSIE, JOHN P.
Research on Dry-Type Cooling Towers for Thermal Electric Generation: Part I,
W72-04829 5D

RUCKEL, H. A.
The Primacy of our Environment over the Economy,
W72-04887 6B

RUCKERT, INGRID
Experimental Investigations into the Influence of Some Organic-Phosphoric Insecticides on the Oxygen Content of Water, (In German),
W72-05258 5C

RUGH, M. C.
Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

RUMINSKA, ANTONINA
Influence of Soil Moisture and NPK Level Upon the Growth and Yield of the Annual Caraway (Carum carvi L. f. Annua.), (In Polish),
W72-05250 3F

RUNKLES, J. R.
Water Stress and Stem Radial Contraction of Cotton Plants (Gossypium hirsutum L.) Under Field Conditions,
W72-04961 3F

RUSSO, F.
Cartridge Magnetic Tape Incremental Recorder for Hydro-Meteorological Data Acquisition,
W72-04848 7A

SABEY, B. R.
The Formation of Nitrate from Ammonium Nitrogen in Soils: IV. Use of the Delay and Maximum Rate Phases for Making Quantitative Predictions,
W72-05120 5B

SAINT-PE, M. A.
Artificial Recharge of Aquifers (Alimentation Artificielle des Nappes),
W72-05044 4B

SAITO, AKIRA
Pigmentation of Brook Trout (Salvelinus fontinalis) by Feeding Dried Crustacean Waste,
W72-04756 2I

SALAZKIN, A. A.
An Analysis of the Fauna of Humic Lakes With Respect to Their Typology, (In Russian),
W72-05206 5C

SAMPSON, R. C.
Structural Measurements With Holographic Interferometry,
W72-04865 8A

SANDEE, A. J. J.
Distribution and Ecology of the Decapoda Reptantia of the Estuarine Area of the Rivers Rhine, Meuse, and Scheldt,
W72-05220 2L

SAVAGE, HUGH P.
Toxicity of Seawater to Coliform Bacteria,
W72-04757 5C

SAWYER, CLAIR N.
ABCs of Cultural Eutrophication and Its Control. Part I--Cultural Changes,
W72-04769 5C

SCALF, M. R.
Probable Impact of NTA on Ground Water,
W72-04800 5B

SCHAD, T. M.
A New Look at National Water Policy,
W72-04882 6B

SCHAUMBERG, FRANK D.
A New Concept in Sample Preservation--Poisoning and Depoisoning,
W72-05012 5A

SCHEIDEGGER, A. E.
Statistical Geometry of Porous Media,
W72-04783 2G

SCHINDLER, D. W.
Seasonal Calorific Values of Freshwater Zooplankton, as Determined with a Phillipson Bomb Calorimeter Modified for Small Samples,
W72-04912 2H

SCHMERENBECK, WALTER
Comparative Studies of Peptone Degradation and the Correlated Population of Ciliates in Models of Flowing and Stagnant Water,
W72-04909 5C

SCHMIT, J. A.
Combined High Speed Liquid Chromatography and Bioassay for the Evaluation and Analysis of an Organophosphorus Larvacide,
W72-04997 5A

SCHMUTZ, ERVIN M.
Germination Responses of Three Desert Grasses to Moisture Stress and Light,
W72-05222 2I

SCHNEIDER, R. F.
The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

SCHRODER, L. J.
Determination of Tritium in Water by the U.S. Geological Survey, Denver, Colorado,
W72-04842 5A

SCHROEDER, DIEDRICH
Contributions to the Genesis and Classification of Marsh Soils: II. On the Sulphur Metabolism of Muds and Salt Marshes, (In German),
W72-04924 2G

SCHUMACHER, DIETER
Cooperation of Government, Science, and Industry in Research and Development - A Systems View,
W72-05075 6B

SCHUMANN, D.
Some Results of Hydromteorological Research Work Carried Out in The Experimental Basins of the Meteorological Service of German Democratic Republic,
W72-05046 2A

SCHUSTER, JOSEPH L.
Woody Phreatophyte Infestation of the Middle Brazos River Floodplain,
W72-05231 3B

SCHWAB, G. D.
Soil Moisture Content, Tilth, and Soybean Response with Surface and Subsurface Drainage,
W72-05145 2G

SCOTT, R. B.
Cost of Reclamation and Mine Drainage Abatement-Elkins Demonstration Project,
W72-05146 5G

SEABURN, G. E.
Catalog of Recharge Basins on Long Island, N.Y., In 1969,
W72-04833 4A

SEITZ, R. C.
Results of a Field Study Using the 3-Axis Doppler Shift Current Meter,
W72-04817 2L

SERVIZI, JAMES A.
Toxicity and Oxygen Demand of Decaying Bark,
W72-04957 5C

SESHADRI, R.
Cultural Estimation of Yeasts on Seaweeds,
W72-04748 5A

SHAH, K. R.
Trace Element Analysis of Environmental Samples by Neutron Activation Method,
W72-04998 5A

SHANE, M. S.
Distribution of Blue-Green Algal Viruses in Various Types of Natural Waters,
W72-04736 5B

SHANKLE, D. F.
Incremental Voltage Uprating of Transmission Lines,
W72-04864 8C

SHAW, R. H.
Special Meteorological Data Needs for Agriculture,
W72-05183 2B

SHCHERBUKHA, A. Y.
Location of Pelecus cultratus Schools in the Southern Bug and Dnieper Rivers,
W72-05271 2I

SHELET, G.
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

SHEPPARD, C. C.
Drying of Poultry Manure in a Cage-Layer House,
W72-05063 5E

Poultry Pollution: Research Results,
W72-05058 5E

The Relationship of Drying Temperature to Total Crude Protein in Dried Poultry Waste,
W72-05062 5E

SHEPPARD, WILLIAM A.
Chemical Stimulants Affecting Larval Settlement in the American Oyster,
W72-04943 5C

SHIFLETT, D. G.
Phosphorus Removal by Luxury Uptake,
W72-05011 5D

SHILO, R.
Thermal Mapping of Selected Sites in the Lake Kinneret Region,
W72-04811 7B

SHIM, JAE HYUNG
A Study on the Brackish Water Type on the Han River Estuary (In Korean),
W72-05203 2L

SHIMMA, H.
A Comparative study on Fatty acid Composition of the Native and Reared Silver Carps, Big Heads, and Grass Carps,
W72-04914 5A

SHIMMA, Y.
A Comparative study on Fatty acid Composition of the Native and Reared Silver Carps, Big Heads, and Grass Carps,
W72-04914 5A

SHIMSHI, D.
Effects of Soil Moisture Stress on Two Varieties of Upland Cotton in Israel: II. The Northern Negev Region,
W72-05180 3F

SHIOZAKI, RYOJI
Microbiological Studies on Nigrogen Cycle in Aquatic Environments: I. Effect of Oxygen Tension on Microflora and Balance of Nitrogeneous Compounds in the Experimental Aquarium.
W72-05164 5C

SHLEMON, ROY J.
Dredge-Tailing Agriculture on the Rio Nechi, Colombia,
W72-05182 3F

SHOTWELL, HENRY P.
The Analysis of Mercury in Urine, Blood, Water, and Air,
W72-05113 5A

SHUKLA, S. S.
Levels of Inorganic and Total Phosphorus in Lake Sediments as Related to Other Sediment Parameters,
W72-04732 5C

SIDDIQUI, A. QAYYUM
Nutrient Regeneration From Dead Freshwater Plankton,
W72-05219 5C

Primary Production in a Tropical Fish Pond at Aligarh, India,
W72-05000 5C

Water, Nitrogen and Phosphorus in Freshwater Plankton,
W72-05009 5C

SIEBURTH, J. M.
Cultural Estimation of Yeasts on Seaweeds,
W72-04748 5A

SIMMONS, D. B.
Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

SIMONS, D. B.
Streamflow, Groundwater and Ground Response Data--Volume II, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05096 7C

SIMONS, W. D.
Hydrology of Hungry Horse Reservoir, Northwestern Montana,
W72-04821 4A

SIMS, CARL W.
Emigration of Juvenile Salmon and Trout from Brownlee Reservoir, 1963-65,
W72-04767 2H

SINGER, A.
Election Micrographs of Lake Kinneret Sediments,
W72-04810 2J

SINGH, C. S.
Studies on Bottom-Living Diatoms of a Freshwater Fish Pond,
W72-05221 2I

SIOLI, H.
Ecology of Freshwater Fishes in Amazonia: Present State of Knowledge and Future Problems, (In German),
W72-05277 2I

SLAVIN, R. H.
A New Dimension of State Planning -- Policy Development and Issue Analysis,
W72-05052 6E

SLECHTA, ALFRED F.
Recent Experiences in Plant-Scale Application of the Settling Tube Concept,
W72-04991 5D

SMITH, D. T.
Herbicides in Narrow-Row Cotton Culture,
W72-05233 3F

SMITH, DWIGHT G.
Age and Length-Weight Composition of a Mud Lake Carp Sample,
W72-05173 2H

SMITH, H. D.
A Technique for Enumerating Kokanee Salmon (Oncorhynchus nerka) Fry Migrating Through Streams, with an Appendix for Processing Catch Data by IBM 360 Fortran IV. Computer Programs,
W72-04752 7C

SMITH, LLOYD L. JR
An Automatic Brine Shrimp Feeder,
W72-04751 7B

Survival and Hatching of Walleye Eggs at Various Dissolved Oxygen Levels,
W72-04935 5C

SMITH, N.
A Survey of Alternate Methods for Cooling Condenser Discharge Water, Total Community Considerations in the Utilization of Rejected Heat,
W72-04830 5D

SMYTHE, F.
Multiple Water Reuse,
W72-04994 5D

SNIPES, R. J.
Hydrologic Data for the San Luis Valley, Colorado,
W72-05025 7C

SNYDER, GEORGE R.
Effects of Increased Temperature on Cold-Water Organisms,
W72-04764 5C

SNYDER, J. H.
Alternative Water Policies for an Arid Region,
W72-04892 6B

SOBEL, A. T.
Block Drying of Chicken Manure,
W72-05054 5D

Gases and Odors from Undiluted and Diluted Chicken Manure,
W72-05071 5B

Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

The Quantitative Determination of the Odor Strength of Chicken Manure,
W72-05069 5A

SOBSEY, M.
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

SOKOLOVA, N. V.
Strontium-90, Strontium and Calcium in some Aquatic Organisms from the Sea of Okhotsk, (In Russian),
W72-04999 5A

SOUTHCOTT, B. A.
Effects of Sodium Chloride on Outgrowth and Toxin Production of Clostridium botulinum Type E in cod Homogenates,
W72-04737 5C

SPARR, ANTON E.
Pumping Sludge Long Distances,
W72-05013 5D

SPENDLOVE, J. C.
Coliform Aerosols Emitted by Sewage Treatment Plants,
W72-04711 5D

SPROUL, OTIS J.
Abatement of Pollution From a Poultry Processing Plant,
W72-05006 5D

SREENIVASAN, A.
Shallow Aquatic Biotopes as Limnological Models,
W72-05023 5C

STANDING, L. J.
Coastal Sedimentation of Southeastern Lake Michigan, Field Trip Guidebook,
W72-04807 2J

STARIDOLSKY, G.
Influence of Soil Moisture and Submergence of Rice Fields on Emergence and Initial Development of Rice (In Bulgarian),
W72-05171 3F

STELIANA, LAZA
A Study of the Influence of Nitrogen and Phosphorus Fertilizers on the Corn Grown on the Alluvial Soils of the Danube Flooded Area,
W72-05116 2G

STELLA, EMILIA
Ianula: An Account of the History and Development of the Lago Di Monterosi, Latium, Italy: IV. Present Ecological Conditions in the Lake,
W72-05208 5C

STEPHENS, G. R.
Carbon Dioxide Exchange of a Tropical Rain Forest: Part I,
W72-05167 2B

STEVENS, M. A.
Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

Streamflow, Groundwater and Ground Response Data--Volume II, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05096 7C

STEWART, G. F.
Effects of Urbanization on Storm Water Runoff Quality: A Limited Experiment, Naismith Ditch, Lawrence, Kansas,
W72-05035 4C

STEYAERT, H.
A Truncated Square-Root-Normal Distribution Applied to Monthly Precipitation Totals for Ghent (Belgium),
W72-05048 2B

STOCK, J. H.
Amphipods of the Genus Gammarus in the Arcachon Basin, (In French),
W72-05276 2I

STRINGER, R.
Amoebic Cysticidal Properties of Halogens in Water,
W72-04746 5F

STUPINA, V. V.
Utilization of Algae Culture for Purification of Wastes of Wool-Washing Installations in Experimental Biological Ponds, (In Russian),
W72-05125 5D

SUGAHARA, ISAO
Microbiological Studies on Nigrogen Cycle in Aquatic Environments: I. Effect of Oxygen Tension on Microflora and Balance of Nitrogeneous Compounds in the Experimental Aquarium.
W72-05164 5C

SUGIYAMA, MOTOHIKO,
Microbiological Studies on Nigrogen Cycle in Aquatic Environments: I. Effect of Oxygen Tension on Microflora and Balance of Nitrogeneous Compounds in the Experimental Aquarium.
W72-05164 5C

SULLIVAN, M. D.
Toughest Air/Water Rules Met by New Kraft Mill at Halsey, Oregon,
W72-04993 5D

SWAMINATHAN, M. S.
Agricultural Research: Progress, Problems and Prospects,
W72-05184 3F

SWAN, J. B.
Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

SWOAGER, W. C.
Isolation and Counting of Athiorhodaceae with Membrane Filters,
W72-04743 5A

SYERS, J. K.
Cation Exchange Selectivity of Some Clay-Sized Minerals and Soil Materials,
W72-05127 2K

Levels of Inorganic and Total Phosphorus in Lake Sediments as Related to Other Sediment Parameters,
W72-04732 5C

SYRIGINA, F. F.
Formation of Zooplankton in the Bratsk Reservoir During the First Two Years of Impoundment, 1962-63 (Formirovaniye zooplanktona v pervyye dva goda zapolneniya Bratskogo vodokhranilishcha (1962-1963 gg.)),
W72-04857 2H

SZEKIELDA, K. H.
Ecological Conditions Caused by Evaporation in the Ponds of Camargue,
W72-05007 2D

TAGARI, H.
Studies on Carp Nutrition: III. Experiments on the Affect on Fish Yield of Dietary Protein Source and Concentration,
W72-05266 2I

TAKAHASHI, MASAYUKI
Photosynthetic Properties and Growth of Photosynthetic Sulfur Bacteria in Lakes,
W72-05085 5C

TAN, R. H. S.
The Load Movement Behavior of Long Piles,
W72-04872 8D

TAN, Y. T.
Preliminary Studies on the Composition of Major Ions of Some Fish Ponds of Malacca in Malaysia,
W72-05107 2H

Proximate Composition of Freshwater Fish Grass Carp, Puntius Gonionotus and Tilapia,
W72-05102 2I

TANJI, K. K.
Specific Conductance Model for Natural Waters and Soil Solutions of Limited Salinity Levels,
W72-05053 2G

TANNER, C. B.
Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

TAPIA, CARLOS R.
Germination Responses of Three Desert Grasses to Moisture Stress and Light,
W72-05222 2I

TAS, A. C.
Characterization of Four Major Components in a Technical Polychlorinated Biphenyl Mixture,
W72-04730 5A

TASH, JERRY C.
Some Crustacean Zooplankton of the Noatak River Area, Northern Alaska,
W72-05166 2H

TAYLOR, ALAN W.
Phosphate Equilibria on Stream Sediment and Soil in a Watershed Draining an Agricultural Region,
W72-04774 5C

TAYLOR, FLOYD B.
Trace Elements and Compounds in Waters,
W72-04969 5F

TAYLOR, JOHN L.
Mollusks and Benthic Environments in Hillsborough Bay, Florida,
W72-04772 2L

TEMIYABUTRA, S.
Rainfall and Run-off from an Industrial Area in Nairobi, Kenya,
W72-04837 4C

TEZUKA, YASUHIKO,
Distribution of Heterotrophic Bacteria and Their Possible Role in the Mineralization of Organic Matter in Yuno-Ko, A Mesotrophic Lake,
W72-05160 5C

THAUER, R. K.
Energy Production in Anaerobic Organisms,
W72-05018 5D

THIEL, P. G.
Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

THOMAS, J. W.
Feeding Dehydrated Poultry Waste to Dairy Cows,
W72-05061 5E

THOMAS, S. B.
An Ecological Study of the Psychrotrophic (SIC) (Psychrophilic) Bacteria of Soil, Water, Grass and Hay,
W72-05158 5B

TODD, GLENN W.
Anatomical Changes in the Shoot Tip of Wheat After Exposure to Drought Stress,
W72-05153 3F

Some Further Observations on Protein Fractions Isolated from Wheat Leaves Subjected to Moisture Stress,
W72-05106 3F

TOETZ, DALE W.
Some Observations on the Limnology of a Pond Receiving Animal Wastes,
W72-04773 5C

TOMLIN, A. D.
DDT in Forest Streams,
W72-04719 5B

TOTH, J.
Groundwater Discharge: A Common Generator of Diverse Geologic and Morphologic Phenomena,
W72-04851 2F

TOTH, STEPHEN J.
Composition of Surface Waters of New Jersey in Relation to Soil Series: II. Waters of the South Branch: Raritan River, Stony Brook, Neshanic River and Assumpink Creek,
W72-05198 5A

TRABUE, IDA M.
Analysis of Coffee, Tea and Artificially Flavored Drinks Prepared from Mineralized Waters,
W72-04782 7B

TRENT, LEE
Setting, Growth and Mortality of Crassostrea virginica in a Natural Marsh and a Marsh Altered by a Housing Development,
W72-04940 5C

TREVALLION, ANN
Studies on Tellina Tenuis Da Costa: III. Aspects of General Biology and Energy Flow,
W72-05112 2L

TRONCONE, M. RIGILLO
Hydrographic Notes on Some Peripheral Tributaries of the Lagoon of Fusaro, (In Italian),
W72-05199 2L

TRONCONE, MARIA RIGILLO
Hydrographic Research Studies of Corona Del Lago Fusaro (Naples), (In Italian),
W72-05255 2L

TSAI, SING-DAO
Some Further Observations on Protein Fractions Isolated from Wheat Leaves Subjected to Moisture Stress,
W72-05106 3F

TUCKER, GEORGE T.
A Method for Predicting Peak Flows From Small Rural Vermont Watersheds,
W72-04897 8B

TULLIS, J. P.
Choking and Supercavitating Valves,
W72-04747 8C

TYLER, B.
The Variability of Seedling Drought Tolerance in Some Cocksfoot (Dactylis glomerata L.) Varieties, (In Rumanian),
W72-05187 3F

TYLER, P. A.
Hyphomicrobia and the Oxidation of Manganese in Aquatic Ecosystems,
W72-05197 5A

VAN BLADEL, ROBERT
The Effect of Water Activity on Ion Exchange Selectivity in Clays,
W72-05135 2G

VAN MEEL, L.
Limnological Studies in Belgium: VII. Two Ponds at Notmeir (Anvers Province). A. Environmental Study,
W72-05214 5C

Limnological Studies in Belgium: VII. Two Ponds at Notmeir (Anvers Province): B. Phytoplanktonic Considerations. C. Conclusions,
W72-05215 5C

VAN MEEL, LUDO
Limnological Studies in Belgium: VI. The Meanders of the Durme River at Hamme (East Flanders Province),
W72-05210 5A

VANDERPUYE, C. J.
Age, Growth and Condition of Black Crappie, Pomoxis nigromaculatus (Le Sueur), in Lewis and Clark Lake, South Dakota, 1954 to 1967,
W72-05264 2H

VANNIER, G.
Importance of the Maximal Hygroscopic Point in a Factorial Analysis of the Biotope of Collembolans (In French),
W72-05178 2G

VARGHESE, S.
The Metabolizeable Energy Value of Dried Poultry Waste,
W72-05065 5E

VASILEV, V.
Influence of Soil Moisture and Submergence of Rice Fields on Emergence and Initial Development of Rice (In Bulgarian),
W72-05171 3F

VERSHININ, N. V.
Formation of Zooplankton in the Bratsk Reservoir During the First Two Years of Impoundment, 1962-63 (Formirovaniye zooplanktona v pervyye dva goda zapolneniya Bratskogo vodokhranilishcha (1962-1963 gg.)),
W72-04857 2H

VICK, PATSY
Some Further Observations on Protein Fractions Isolated from Wheat Leaves Subjected to Moisture Stress,
W72-05106 3F

VILEN, FRANK I.
Process Evaluation--Phosphorus Removal,
W72-04979 5D

VITTORI, ALVISE,
Ecological Observations on the Alterations in the Lake Biocenosis of Tovel Lake (Trentino), (In Italian),
W72-05165 5C

VOGEL, J. C.
Radiocarbon in Nature,
W72-05110 7B

VOLOSHCHENKO, O. I.
A Hygienic Evaluation of the New Plasticizer Tolylnaphthylmethane,
W72-05236 5C

WADE, RICHARD ARCHER
Ecology of Juvenile Tarpon and Effects of Dieldrin on Two Associated Species,
W72-04927 5C

WAGGONER, P. E.
Carbon Dioxide Exchange of a Tropical Rain Forest: Part I,
W72-05167 2B

WAGLE, R. F.
Understanding a Watershed from the Biological Viewpoint,
W72-04955 4D

WAHLBERG, PETER
Human Exposure to Mercury from Goosander Eggs Containing Methyl Mercury,
W72-05114 5C

WALLER, J. M.
A Simple Wetness Recorder,
W72-05152 7B

WALOMAN, CARL H.
Mollusks and Benthic Environments in Hillsborough Bay, Florida,
W72-04772 2L

WALSH, F.
Application of Stream Order Numbers to the Merrimack River Basin,
W72-05036 4A

WALSH, GERALD E.
Energy Budgets of Four Ponds in Northwestern Florida,
W72-04907 2D

WALTZ, J. P.
Methods of Geologic Evaluation of Pollution Potential at Mountain Homesites,
W72-04803 5B

WANG, S. N.
Groundwater Flow in a Sandy Tidal Beach: Two-Dimensional Finite Element Analysis,
W72-05033 2F

WATERS, THOMAS F.
Diel Patterns of Aquatic Invertebrate Drift in Streams of Northern Utah,
W72-05275 2I

WATKINS, J. L.
Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

WATTERS, R. L.
210PoO2 Movement in a Mountain Watershed Soil,
W72-04920 5B

WEBBER, E. E.
Floods of July 4-8, 1969 in North-Central Ohio,
W72-04852 2E

WEBER, DON T.
Boom Applicator for Aquatic Herbicides,
W72-04707 8I

WEBSTER, GEORGE R.
Nutrients and Carbon Dioxide in the Columbia River,
W72-04974 5B

WEI, C. -Y.
Finite Difference Solutions of Axisymmetric Infiltration Through Partially Saturated Porous Media,
W72-04805 2G

WEIMER, W. C.
Method For the Storage of Samples For Dissolved Gas Analyses,
W72-04729 5A

WEISS, C. M.
Ecology and Man, The Dilemma of Our Technological Culture,
W72-05084 6B

WELCH, EUGENE B.
The Total Organic Carbon Analyzer and Its Application to Water Research,
W72-05001 5A

WENGERT, N.
Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

WEST, E.
The Growth of Pores in Graphitized Carbon Reacted with Carbon Dioxide,
W72-04704 5D

WESTLEY, RONALD E.
The Oyster Producing Potential of Puget Sound,
W72-04725 2I

WHEELER, WILLIAM C.
Design and Operation of an Extended Aeration Plant,
W72-04973 5D

WHITE, DAVID A.
Age and Length-Weight Composition of a Mud Lake Carp Sample,
W72-05173 2H

WHITE, E. M.
Soil-Desiccation Features in South Dakota Depressions,
W72-04812 2G

WHITEHEAD, P. J. P.
Natural Hybrids of the African Cichlid Fishes Tilapia spirlurus nigra and T. leucosticta: A Case of Hybrid Introgression,
W72-05270 2I

WIERSMA, J. H.
Selenium in Lake Sediments - Analytical Procedure and Preliminary Results,
W72-04733 5A

WIESE, A. F.
Herbicides in Narrow-Row Cotton Culture,
W72-05233 3F

WILEY, C. R.
Effect of Water Table Depth and Flooding on Yield of Millet,
W72-05124 2G

WILLIAMS, AUSTIN B.
A Ten-Year Study of Meroplankton in North Carolina Estuaries: Annual Occurrence of Some Brachyuran Developmental Stages,
W72-04903 2L

WILLIAMS, GEORGE F.
A Computerized Educational Program for the Application of the Management Sciences to Water Resource Management,
W72-05088 7C

WILLIAMS, J. D. H.
Levels of Inorganic and Total Phosphorus in Lake Sediments as Related to Other Sediment Parameters,
W72-04732 5C

WILLIAMS, J. R.
Hymo, A Problem-Oriented Computer Language for Building Hydrologic Models,
W72-05028 7C

WILLIAMSON, R. E.
Effect of Water Table Depth and Flooding on Yield of Millet,
W72-05124 2G

WILLMAN, H. B.
Farmdalian Lake Deposits and Faunas in Northern Illinois,
W72-04834 2H

WILMOTH, B. M.
Salty Ground Water and Meteoric Flushing of Contaminated Aquifers in West Virginia,
W72-04801 5B

WILMOTH, R. C.
Cost of Reclamation and Mine Drainage Abatement-Elkins Demonstration Project,
W72-05146 5G

WILSON, A. G.
Forecasting Planning,
W72-05082 6B

WILSON, L. L.
Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

WILSON, R. S.
The Decline of a Roach Rutilus Rutilus (L.) Population in Chew Valley Lake,
W72-04706 2H

WIRSCHAL, H. H.
Reversible Pump/Turbines for Raccoon Mountain,
W72-04874 8C

WISSING, THOMAS E.
Intraseasonal Changes in Caloric Content of Some Freshwater Invertebrates,
W72-04722 2I

WOLFF, W. J.
Distribution and Ecology of the Decapoda Reptantia of the Estuarine Area of the Rivers Rhine, Meuse, and Scheldt,
W72-05220 2L

WOOD, P. R.
Water Chemistry of the Santa Clara Valley, California,
W72-04835 2K

WOODARD, FRANKLIN E.
Abatement of Pollution From a Poultry Processing Plant,
W72-05006 5D

WOODSWORTH, G. J.
A Geochemical Drainage Survey and Its Implications for Metallogenesis, Central Coast Mountains, British Columbia,
W72-04798 2K

WUENSCHER, JAMES E.
The Response of Transpiration Resistance to Leaf Temperature as a Desiccation Resistance Mechanism in Tree Seedlings,
W72-05244 2D

YANEY, N. D.
210PoO2 Movement in a Mountain Watershed Soil,
W72-04920 5B

YATES, M. L.
Organochlorine Insecticide Residues in Everglades National Park and Loxahatchee National Wildlife Refuge, Florida,
W72-04799 5B

YEFIMOV, G. S.
Water Balance and Regionalization of Drainage in the Turkmen SSR (Vodnyy balans i rayonirovaniye drenazha v Turkmenskoy SSR),
W72-04861 4A

YEVICH, PAUL P.
Histological and Hematological Responses of an Estuarine Teleost to Cadmium,
W72-04709 5C

YMAMOTO, A.
Study on the New Strain of the Pathogenic 'Vibrio' Isolated from Freshwater Fishes,
W72-04720 5A

YOSHPE-PURER, Y.
A Convenient Method for Isolation of Salmonellae from Sewage and Contaminated Sea Water,
W72-04919 5D

YOUNG, H. W.
Ground-Water Pumpage from the Snake Plain Aquifer, Southeastern Idaho,
W72-04820 4B

YOUNGNER, V. B.
Ecological and Physiological Implications of Greenbelt Irrigation,
W72-04898 6G

YU, Y. S.
Runoff from Impervious Surfaces,
W72-04844 4C

YULE, W. N.
DDT in Forest Streams,
W72-04719 5B

ZABAT, MARIO D.
Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

ZABLATZKY, HERMAN R.
Discussion of 'Toxic Effects of Ammonia Nitrogen in High Rate Digestion',
W72-05016 5D

ZACEK, K.
Virological Surveys of the Presence of Enteroviruses in Waste Water: I. Incidence of Polio-viruses in Prague at the End of 1963 and in 1969, (In Czech),
W72-05226 5B

ZDRAZILEK, J.
Virological Surveys of the Presence of Enteroviruses in Waste Water: I. Incidence of Polio-viruses in Prague at the End of 1963 and in 1969, (In Czech),
W72-05226 5B

ZIEGLER, J. H.
Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

ZILLIOUX, E. J.
Advances in the Continuous Culture of Planktonic Copepods,
W72-04900 5A

ZINDEL, H. C.
Dried Poultry Waste as a Protein Source for Feedlot Cattle,
W72-05064 5E

Early Experiments at Michigan State University Involving the Use of Chicken Manure,
W72-05059 5E

Economics of Dried Poultry Waste (DPW) as a Feed Ingredient or a Fertilizer,
W72-05060 5E

Feeding Dehydrated Poultry Waste to Dairy Cows,
W72-05061 5E

ORGANIZATIONAL INDEX

ABERDEEN UNIV. (SCOTLAND). DEPT. OF BOTANY.
Epicuticular Wax in the Stomatal Antechamber of Sitka Spruce and Its Effects on the Diffusion of Water Vapour and Carbon Dioxide,
W72-05241 2D

ACADEMIA R.S.R., BUCHAREST (RUMANIA). INSTITUTUL DE BIOLOGIE.
On The Importance of Temporary Pools and Their Protection, (In Rumanian),
W72-05278 2I

ACADEMY OF AGRICULTURAL SCIENCES, STARA ZAGORA (BULGARIA). EXPERIMENT STATION OF IRRIGATED AGRICULTURE.
Microfertilizing with Mo of Irrigated Alfalfa Grown on Cinnamon Forest Soil in South Bulgaria (In Bulgarian),
W72-05174 3F

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, PA.
Ianula: An Account of the History and Development of the Lago Di Monterosi, Latium, Italy: VIII. The Fossil Flora and Fauna (Other Than Siliceous Fossils, Pollen, and Chironomid Head Capsules),
W72-05207 5C

ADADEMIYA NAUK URSR, KIEV. INSTYTUT ZOOLOGII.
Location of Pelecus cultratus Schools in the Southern Bug and Dnieper Rivers,
W72-05271 2I

ADELAIDE UNIV. (AUSTRALIA). DEPT. OF BOTANY.
Lichen Populations on Arid Soil Crusts Around Sheep Watering Places in South Australia,
W72-04790 2I

AEROJET-GENERAL CORP., EL MONTE, CALIF.
Auxiliary Sewage Storage System for Temporarily Storing Sewage,
W72-05022 5D

AEROJET NUCLEAR SYSTEMS CORP., SACRAMENTO, CALIF.
Structural Measurements With Holographic Interferometry,
W72-04865 8A

AGRICULTURAL RESEARCH COUNCIL, ABERYSTWYTH (WALES). WELSH PLANT BREEDING STATION.
The Variability of Seedling Drought Tolerance in Some Cocksfoot (Dactylis glomerata L.) Varieties, (In Rumanian),
W72-05187 3F

AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. FIELD CROPS AND ANIMAL PRODUCTS RESEARCH BRANCH.
Effect of Growth Regulator and Anti-Transpirant Chemicals on Water Requirement and Growth Components of Alfalfa (Medicago sativa L.),
W72-05232 3F

AGRICULTURAL RESEARCH SERVICE, BELTSVILLE, MD. SOIL AND WATER CONSERVATION RESEARCH DIV.
Phosphate Equilibria on Stream Sediment and Soil in a Watershed Draining an Agricultural Region,
W72-04774 5C

AGRICULTURAL RESEARCH SERVICE, BIG SPRING, TEX. SOIL AND WATER CONSERVATION RESEARCH DIV.
Survival and Growth of Cotton Plants Damaged by Windblown Sand,
W72-04918 3F

AGRICULTURAL RESEARCH SERVICE, KIMBERLY, IDAHO. SNAKE RIVER RESEARCH CENTER.
Plant Water Potential Gradients Measured in the Field by Freezing Point,
W72-05239 3F

AGRICULTURAL RESEARCH SERVICE, LOGAN, UTAH. PLANT SCIENCE RESEARCH DIV.
Limits on Western Range Forage Production: Water or Man,
W72-05230 4A

AGRICULTURAL RESEARCH SERVICE, PHOENIX, ARIZ.
Critical-Depth Flumes for Determining Flow in Canals and Natural Channels,
W72-04871 8B

AGRICULTURAL RESEARCH SERVICE, PROSSER, WASH. SOIL AND WATER CONSERVATION RESEARCH DIV.
Phosphorus Fertilization of Hops,
W72-05148 5B

AGRICULTURAL RESEARCH SERVICE, RALEIGH, N.C.
Effect of Water Table Depth and Flooding on Yield of Millet,
W72-05124 2G

AGRICULTURAL RESEARCH SERVICE, RIESEL, TEX. SOIL AND WATER RESEARCH DIV.
Hymo, A Problem-Oriented Computer Language for Building Hydrologic Models,
W72-05028 7C

AGRICULTURAL RESEARCH SERVICE, RIVERSIDE, CALIF. SALINITY LAB.
In Situ Measurement of Soil and Plant Leaf Water Potential,
W72-05136 2D

AGRICULTURAL RESEARCH SERVICE, WESLACO, TEX. SOIL AND WATER CONSERVATION RESEARCH DIV.
Water Stress and Stem Radial Contraction of Cotton Plants (Gossypium hirsutum L.) Under Field Conditions,
W72-04961 3F

AGRICULTURAL RESEARCH SERVICE, WOOSTER, OHIO. SOIL AND WATER CONSERVATION RESEARCH DIV.
Soil Moisture Content, Tilth, and Soybean Response with Surface and Subsurface Drainage,
W72-05145 2G

AGRICULTURAL RESEARCH STATION, LEETON (AUSTRALIA).
Effect of Gypsum and Drought Stress on Maize (Zea mays L.): I. Growth, Light Absorption and Yield,
W72-05188 3F

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). LAB. OF MICROBIOLOGY.
Some Characteristics of Arthrobacters from a Dairy Waste Activated Sludge,
W72-05103 5B

AIN SHAMS UNIV., CAIRO (EGYPT).
The Water Outlay by Eichhornia crassipes and Observations on the Plant Chemical Control,
W72-05247 4A

AIN SHAMS UNIV., CAIRO (EGYPT). DEPT. OF SOILS.
The Influence of Soil Moisture on Phosphorus Uptake by Corn and on the Efficiency of Added Superphosphate,
W72-05217 3F

AKADEMIYA NAUK SSSR, LENINGRAD. INSTITUT EVOLYUTSIONNOI FIZIOLOGII I BIOKHIMII.
Modelling of Populations and Communities of Aquatic Animals on Digital Computers (In Russian),
W72-05175 2H

AKADEMIYA NAUK SSSR, MOSCOW. INSTITUT BIOLOGII VNUTRENNYKH VOD.
Caspian Fauna in the Black Sea (Beyond the Limits of Freshwater Regions), (In Russian),
W72-05162 2L

AKADEMIYA NAUK SSSR, MOSCOW. INSTITUT OKEANOLOGII.
An Active Method for Correcting the Frequency Response of the Temperature Sensors of Oceanological Instruments,
W72-04749 7B

AKADEMIYA NAUK URSR, KIEV. INSTYTUT BOTANIKI.
Utilization of Algae Culture for Purification of Wastes of Wool-Washing Installations in Experimental Biological Ponds, (In Russian),
W72-05125 5D

ALAND CENTRAL HOSPITAL MARIEHAMN (FINLAND).
Human Exposure to Mercury from Goosander Eggs Containing Methyl Mercury,
W72-05114 5C

ALASKA UNIV., COLLEGE. INST. OF MARINE SCIENCES.
Effect of Upwelling, Mixing, and High Primary Productivity on CO2 Concentrations in Surface Waters of the Bering Sea,
W72-05038 2K

ALIGARH MUSLIM UNIV. (INDIA). DEPT. OF ZOOLOGY.
Primary Production in a Tropical Fish Pond at Aligarh, India,
W72-05000 5C

Water, Nitrogen and Phosphorus in Freshwater Plankton,
W72-05009 5C

Nutrient Regeneration From Dead Freshwater Plankton,
W72-05219 5C

ALLIS-CHALMERS CORP., YORK, PA.
Reversible Pump/Turbines for Raccoon Mountain,
W72-04874 8C

AMERICAN STANDARD INC., NEW BRUNSWICK, N.J.
An Empirical Method for Determining the Concentration of Solids in Suspension,
W7204731 5A

AMSTERDAM UNIV. (NETHERLANDS). INST. OF TAXONOMIC ZOOLOGY.
Research on the Level of Chlorinity of the Interstitial Water in the Bed of the Slack River, (In Dutch),
W72-05211 2L

ARIZONA STATE UNIV., TEMPE. COLL. OF ENGINEERING SCIENCES.
Survival of Coliform Bacteria in Wastewater Treatment Lagoons,
W72-04976 5D

ARIZONA STATE UNIV., TEMPE. DEPT. OF ZOOLOGY.
Some Aspects of Biology of the Longfin Dace, a Cyprinid Fish Characteristic of Streams in the Sonoran Desert,
W72-04723 2I

Effects of Salinity on the Survival and Growth of Pre-Smolt Coho Salmon (Oncorhynchus kisutch),
W72-04775 8I

Influence of Rate of Feeding and Body Weight on Protein Metabolism of Bluegill Sunfish,
W72-05262 2I

ARIZONA UNIV., TUCSON.
Space-Time Sampling of Ecological Systems,
W72-04779 6A

Some Crustacean Zooplankton of the Noatak River Area, Northern Alaska,
W72-05166 2H

ARIZONA UNIV., TUCSON. DEPT. OF WATERSHED MANAGEMENT.
Understanding a Watershed from the Biological Viewpoint,
W72-04955 4D

ARIZONA UNIV., TUCSON. ENVIRONMENTAL RESEARCH LAB.
The Effect of Relative Humidity on Growth, Yield, and Water Consumption of Bean Plants,
W72-04926 3F

ARMY COASTAL ENGINEERING RESEARCH CENTER, WASHINGTON, D.C.
On the Generation of Long Waves,
W72-05039 2E

AUBURN UNIV., ALA.
Nutrient Removal by Waterhyacinth,
W72-04776 5C

AUBURN UNIV., ALA. DEPT. OF CIVIL ENGINEERING.
Interaction of Water Uptake and Root Distribution,
W72-05242 3F

BATTELLE MEMORIAL INST., RICHLAND, WASH.
Chondrococcus columnaris Disease of Fishes: Influence of Columbia River Fish Ladders,
W72-04959 5B

BECK (R. W.) AND ASSOCIATES, DENVER, COLO.
Research on Dry-Type Cooling Towers for Thermal Electric Generation: Part I,
W72-04829 5D

BELL TELEPHONE LABS., INC., MURRAY HILL, N.J.; AND BELL TELEPHONE LABS., INC., WHIPPANY, N.J.
Laser Holography and Interferometry in Materials Research,
W72-04873 7B

BERGEN COUNTY SEWER AUTHORITY, LITTLE FERRY, N.J.
Discussion of 'Toxic Effects of Ammonia Nitrogen in High Rate Digestion',
W72-05016 5D

BONN UNIV. (WEST GERMANY). PHARMAKOGNOSTISCHES INSTITUT.
Annual Changes in Osmotic Conditions and Carbohydrate Contents in East-Afghanistan Trees I. Quercus Balout Griffith, (In German),
W72-05260 2I

BONN UNIV. (WEST GERMANY). ZOOLOGICAL INST.
Comparative Studies of Peptone Degradation and the Correlated Population of Ciliates in Models of Flowing and Stagnant Water,
W72-04909 5C

BORDEAUX (FRANCE).
Bordeaux: Study of Atmospheric Pollution on the Built-Up Area,
W72-04923 5B

BOSTON COLL., CHESTNUT HILL, MASS.
Community Decision Behavior: The Culture of Planning,
W72-04760 6A

BOSTON INDUSTRIAL MISSION, CAMBRIDGE, MASS.
Periolous Links Between Economic Growth, Justice and Ecology: A Challenge for Economic Planners,
W72-04956 6B

BRIGHMAN YOUNG UNIV., PROVO, UTAH.
Age and Length-Weight Composition of a Mud Lake Carp Sample,
W72-05173 2H

BRISTOL UNIV. (ENGLAND). DEPT. OF ZOOLOGY.
The Decline of a Roach Rutilus Rutilus (L.) Population in Chew Valley Lake,
W72-04706 2H

BRITISH COLUMBIA DEPT. OF RECREATION AND CONSERVATION, VICTORIA. FISH AND WILDLIFE BRANCH.
A Technique for Enumerating Kokanee Salmon (Oncorhynchus nerka) Fry Migrating Through Streams, with an Appendix for Processing Catch Data by IBM 360 Fortran IV. Computer Programs,
W72-04752 7C

BRITISH COLUMBIA UNIV., VANCOUVER. INST. OF ANIMAL RESOURCES AND ECOLOGY.
A Core Sampler for Semi-Fluid Substrates,
W72-05008 7B

BUREAU OF COMMERCIAL FISHERIES, GULF BREEZE, FLA. ESTUARINE PESTICIDE LAB.
Energy Budgets of Four Ponds in Northwestern Florida,
W72-04907 2D

BUREAU OF COMMERCIAL FISHERIES, SEATTLE, WASH. SEATTLE BIOLOGICAL LAB.
Emigration of Juvenile Salmon and Trout from Brownlee Reservoir, 1963-65,
W72-04767 2H

Distribution and Movement of Juvenile Salmon in Brownlee Reservoir, 1962-65,
W72-04768 2H

Migration of Juvenile Salmon and Trout into Brownlee Reservoir, 1962-65,
W72-04771 2H

BUREAU OF COMMERCIAL FISHERIES, ST. PETERSBURG BEACH, FLA. BIOLOGICAL LAB.
Mollusks and Benthic Environments in Hillsborough Bay, Florida,
W72-04772 2L

BUREAU OF MINES, BARTLESVILLE, OKLA. BARTLESVILLE PETROLEUM RESEARCH CENTER.
Solubility of Barium and Strontium Sulfates in Strong Electrolyte Solutions,
W72-04793 5G

BUREAU OF OUTDOOR RECREATION, WASHINGTON, D.C.
The Role of Recreation and Environmental Quality in Water Management,
W72-04894 6B

BUREAU OF RECLAMATION, DENVER, COLO.
Hydrometeorology in Precipitation Management,
W72-04866 6B

Experimental Cationic Asphalt Emulsion Grouting,
W72-04869 8G

BUREAU OF RECLAMATION, WASHINGTON, D.C.
Partial Solutions--The Outlook,
W72-04890 6B

BUREAU OF SPORT FISHERIES AND WILDLIFE, KEARNEYSVILLE, W. VA.
Oxytetracycline Residues in Different Tissues of Trout,
W72-04928 5C

Oxytetracycline Toxicity to Trout,
W72-04931 5C

Oxytetracycline Sensitivity of Selected Fish Pathogens,
W72-04932 5C

Oxytetracycline in Fish Culture: A Review,
W72-04933 5C

BUREAU OF SPORT FISHERIES AND WILDLIFE, LAUREL, MD. PATUXENT WILDLIFE RESEARCH CENTER.
Semiquantitative Determination of Polychlorinated Biphenyls in Tissue Samples by Thin Layer Chromatography,
W72-04946 5A

BUREAU OF SPORT FISHERIES AND WILDLIFE, LONGVIEW, WASH. SALMON-CULTURAL LAB.
The Abernathy Salmon Diet,
W72-04728 2I

BUREAU OF SPORT FISHERIES AND WILDLIFE, SEATTLE, WASH.
Oxytetracycline Efficacy as a Treatment for Furunculosis in Coho Salmon,
W72-04929 5C

BUREAU OF SPORT FISHERIES AND WILDLIFE, WASHINGTON, D.C.
Expanded Program for Pesticide Monitoring of Fish,
W72-04740 5A

BUREAU OF SPORT FISHERIES AND WILDLIFE, WASHINGTON, D.C. DIV. OF FISHERY RESEARCH.
Biology of the Crayfish Orconectes causeyi and Its Use for Control of Aquatic Weeds in Trout Lakes,
W72-04962 4A

Organochlorine Insecticide Residues in Fish-Fall 1969: National Pesticide Monitoring Program,
W72-04982 5A

BUREAU OF THE BUDGET, WASHINGTON, D.C. PROGRAM EVALUATION.
Water Resource Investments and National Goals,
W72-04891 6B

CALGARY UNIV. (ALBERTA). DEPT. OF GEOOGY.
An Improved Dianthrimide Technique for the Determination of Boron in River Waters,
W72-05109 5A

CALIFORNIA UNIV., BERKELEY. DEPT. OF GEOGRAPHY.
Morphogenesis of Granitic Boulder Slopes in the Mojave Desert, California,
W72-04813 2J

CALIFORNIA UNIV., BERKELEY. DEPT. OF SANITARY ENGINEERING.
Alternatives in Water Management,
W72-04893 6B

CALIFORNIA UNIV., BERKELEY. SANITARY ENGINEERING RESEARCH LAB.
Kinetics of Algal Systems in Waste Treatment--Ammonia-Nitrogen as a GrowthLimiting Factor and Other Pertinent Topics,
W72-04787 5D

Kinetics of Algal Systems in Waste Treatment--Phosphorus as a Growth Limiting Factor,
W72-04788 5D

Kinetics of Algal Systems in Waste Treatment Field Studies,
W72-04789 5D

CALIFORNIA UNIV., DAVIS. DEPT. OF FOOD SCIENCE AND TECHNOLOGY.
Analysis of Coffee, Tea and Artificially Flavored Drinks Prepared from Mineralized Waters,
W72-04782 7B

CALIFORNIA UNIV., DAVIS. DEPT. OF GEOGRAPHY.
Dredge-Tailing Agriculture on the Rio Nechi, Colombia,
W72-05182 3F

CALIFORNIA UNIV., DAVIS. DEPT. OF WATER SCIENCE AND ENGINEERING.
The Amelioration of Gley and Pseudogley Soils,
W72-04899 2G

Specific Conductance Model for Natural Waters and Soil Solutions of Limited Salinity Levels,
W72-05053 2G

CALIFORNIA UNIV., DAVIS. ECONOMIC RESEARCH SERVICE; AND CALIFORNIA UNIV., DAVIS. DEPT. OF AGRICULTURAL ENGINEERING.
Alternative Water Policies for an Arid Region,
W72-04892 6B

CALIFORNIA UNIV., LOS ANGELES.
The Future of Western Water Development,
W72-04879 6B

CALIFORNIA UNIV., RIVERSIDE.
Dead Bird Disposal by Rendering,
W72-05055 5E

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF PLANT SCIENCES.
Ecological and Physiological Implications of Greenbelt Irrigation,
W72-04898 6G

CALIFORNIA UNIV., SANTA CRUZ.
The Environmental Movement: Ambiguities and Meanings,
W72-05021 6B

CAMP, DRESSER AND MCKEE, BOSTON, MASS.
Microstraining Paper Mill Wastewater,
W72-04996 5D

CANADA AGRICULTURAL RESEARCH STATION, SASKATOON (SASKATCHEWAN).
Relations between Water Status, Leaf Temperature Stomatal Aperture, and Productivity of Some Wheat Varieties (In German),
W72-05185 3F

CANBERRA COLL. OF ADVANCED EDUCATION (AUSTRALIA).
Causes of Spheroidal Weathering,
W72-04794 2J

CARNEGIE-MELLON UNIV., PITTSBURGH, PA. DIV. OF SPONSORED RESEARCH.
Stochastic Modeling of Temperature and Flow in Rivers,
W72-05030 2A

CELOTEX CORP., LANSING, MICH.
Disposal of Insulation Board Mill Effluent by Land Irrigation,
W72-05002 5D

CENTER FOR ENVIRONMENTAL STUDIES, LONDON (ENGLAND).
Forecasting Planning,
W72-05082 6B

CENTRAL INLAND FISHERIES RESEARCH INST., CUTTACK (INDIA). FISHERIES RESEARCH STATION.
Studies on Bottom-Living Diatoms of a Freshwater Fish Pond,
W72-05221 2I

CENTRAL INST. FOR NUTRITION AND FOOD RESEARCH TNO, ZEIST (NETHERLANDS).
Characterization of Four Major Components in a Technical Polychlorinated Biphenyl Mixture,
W72-04730 5A

CENTRAL SEWAGE TREATMENT PLANT, BRNO (CZECHOSLAVAKIA).
Influence of Temperature on Anaerobic Digestion,
W72-05010 5D

CENTRE D'OCEANOGRAPHIE, MARSEILLE (FRANCE).
Ecological Conditions Caused by Evaporation in the Ponds of Camargue,
W72-05007 2D

CENTRE D'OCEANOGRAPHIE, MARSEILLE (FRANCE). STATION MARINE D'ENDOUME.
Experimental Study of the Formation of a Population on Loose Ground from Meroplanktonic Larvae, (In French),
W72-05256 7B

CESKOSLOVENSKA AKADEMIE VED, BRNO. BOTANICKA USTAV.
Flooded Meadow Communities. An Analysis of Productivity in a Dry Year,
W72-05265 2I

CHANCELLOR COLL., LIMBE (MALAWI).
The Rate of Nutrient Release from Grass and Dung Following Immersion in Lake Water,
W72-05020 2H

CHEMICAL CONTROL RESEARCH INST, OTTAWA (ONTARIO),
DDT in Forest Streams,
W72-04719 5B

CLEMSON UNIV., S.C.
The Economic Feasibility of Treating Textile Wastes in Municipal Systems,
W72-04989 5D

COASTAL PLAINS CENTER FOR MARINE DEVELOPMENT SERVICES, WILMINGTON, N.C.
Bibliography of Products Derived from Aquatic Organisms.
W72-05086 5D

Bibliography of Aquaculture.
W72-05087 5C

COLORADO COOPERATIVE FISHERY UNIT, FORT COLLINS.
Boom Applicator for Aquatic Herbicides,
W72-04707 8I

COLORADO STATE UNIV., FORT COLLINS.
Political and Social Accommodation: The Political Process and Environmental Preservation,
W72-05083 6E

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Choking and Supercavitating Valves,
W72-04747 8C

Precipitation Data and Analysis--Volume I, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05095 7C

Streamflow, Groundwater and Ground Response Data--Volume II, Venezuelan International Meteorological and Hydrological Experiment (VIMHEX) Hydrology Report,
W72-05096 7C

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF GEOLOGY.
Methods of Geologic Evaluation of Pollution Potential at Mountain Homesites,
W72-04803 5B

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF RADIOLOGY AND RADIATION BIOLOGY.
210PoO2 Movement in a Mountain Watershed Soil,
W72-04920 5B

COLORADO STATE UNIV., FORT COLLINS. ENVIRONMENTAL RESOURCES CENTER.
Water and Western Destiny: From Conflict to Cooperation.
W72-04878 6B

COLORADO UNIV., BOULDER. DEPT. OF CHEMICAL ENGINEERING.
The Growth of Pores in Graphitized Carbon Reacted with Carbon Dioxide,
W72-04704 5D

COLORADO UNIV., BOULDER. DEPT. OF CIVIL ENGINEERING.
Trace Element Removals in Advanced Wastewater Treatment Processes,
W72-04972 5D

COMMITTEE ON PUBLIC WORKS (U.S. SENATE).
Strategies for Control of Man-Made Eutrophication,
W72-04734 5D

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF LAND RESEARCH.
Hydrodynamic Dispersion in Aggregated Media: 1. Theory,
W72-05122 2G

Gravity Segregation During Miscible Displacement Experiments,
W72-05126 2G

The Analysis of Experiments on Hydrodynamic Dispersion,
W72-05128 2G

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF LAND RESEARCH AND REGIONAL SURVEY.
A Physical Analysis of Diurnal Temperature Regimes in Clear and Turbid Water Layers: A Problem in Rice Culture,
W72-05144 2D

CONNECTICUT AGRICULTURAL EXPERIMENT STATION, NEW HAVEN.
Carbon Dioxide Exchange of a Tropical Rain Forest: Part I,
W72-05167 2B

CONNECTICUT AGRICULTURAL EXPERIMENT STATION, WINDSOR. VALLEY LAB.
Water Stress Gradients in Plants and Soil-Root Systems,
W72-05139 2G

CONNECTICUT UNIV., STORRS. DEPT. OF AGRICULTURAL ENGINEERING.
Design and Operation of an Extended Aeration Plant,
W72-04973 5D

CONNECTICUT UNIV., WEST HARTFORD. SCHOOL OF LAW.
Riparian Water Law. A Functional Analysis,
W72-05097 6E

CORNELL UNIV., ITHACA, N.Y.
Alternatives for the Treatment and Disposal of Animal Wastes,
W72-04937 5D

Carbon Dioxide Exchange of a Tropical Rain Forest: Part II,
W72-05168 2B

CORNELL UNIV., ITHACA, N.Y. DEPT. OF AGRICULTURAL ENGINEERING.
Block Drying of Chicken Manure,
W72-05054 5D

Odors, Gases and Particulate Matter from High Density Poultry Management Systems as They Relate to Air Pollution,
W72-05067 5B

The Quantitative Determination of the Odor Strength of Chicken Manure,
W72-05069 5A

Gases and Odors from Undiluted and Diluted Chicken Manure,
W72-05071 5B

CORNELL UNIV., ITHACA, N.Y. DEPT. OF FOOD SCIENCE.
The Qualitative Determination of the Odor Quality of Chicken Manure,
W72-05068 5B

Analyses of Gases Encountered in a Commercial Poultry House,
W72-05070 5A

Particulate Matter,
W72-05072 5A

Soil Filtration to Remove Odors,
W72-05073 5D

CORNELL UNIV., ITHACA, N.Y. DEPT. OF FOOD SCIENCES.
Odor Controls by Chemical Treatment,
W72-05074 5D

CORNELL UNIV., ITHACA, N.Y. PESTICIDE RESIDUE LAB.
Rapid Determination of Mercury in Fish,
W72-04948 5A

COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, PRETORIA (SOUTH AFRICA). NATIONAL PHYSICAL RESEARCH LAB.
Radiocarbon in Nature,
W72-05110 7B

CRANE CO., KING OF PRUSSIA, PA. COCHRANE DIV.
Microstraining of Combined Sewer Overflows,
W72-04971 5D

DARTMOUTH COLL., HANOVER, N.H. DEPT. OF EARTH SCIENCES.
Equilibrium Temperatures of Water Surfaces as Related to Air Temperature and Solar Radiation,
W72-05026 2B

DELAWARE UNIV., LEWES. COLL. OF MARINE STUDIES.
Holding and Spawning Delaware Bay Oysters (Crassostrea virginica) Out of Season: II. Temperature Requirements for Maturation of Gonads,
W72-04942 5C

Chemical Stimulants Affecting Larval Settlement in the American Oyster,
W72-04943 5C

DELAWARE UNIV., NEWARK. DEPT. OF BIOLOGICAL SCIENCES.
Distribution of Blue-Green Algal Viruses in Various Types of Natural Waters,
W72-04736 5B

DELTA INST. OF HYDROBIOLOGICAL RESEARCH, YERSEKE (NETHERLANDS).
Distribution and Ecology of the Decapoda Reptantia of the Estuarine Area of the Rivers Rhine, Meuse, and Scheldt,
W72-05220 2L

DEPARTMENT OF AGRICULTURE OF NEW SOUTH WALES, LEETON (AUSTRALIA). AGRICULTURAL RESEARCH STATION.
Effect of Gypsum and Drought Stresses on Maize (Zea Mays L.): II. Consumptive Use of Water,
W72-04917 3F

DEPARTMENT OF AGRICULTURE, OTTAWA (ONTARIO). ENTOMOLOGY RESEARCH INST.
Spring and Early Summer Temperatures in a Shallow Arctic Pond,
W72-05163 2C

DEPARTMENT OF AGRICULTURE, OTTAWA (ONTARIO). PLANT RESEARCH INST.
Concepts of Soil Moisture Availability and Their Effect on Soil Moisture Estimates from a Meteorological Budget,
W72-05149 2D

DEPARTMENT OF AGRICULTURE, SWIFT CURRENT (SASKATCHEWAN). RESEARCH STATION.
Stand Patterns for Alfalfa-Grass Hay Production in a Dry Climate,
W72-05223 3F

DEPARTMENT OF AGRICULTURE, WESLACO, TEX.
Reflectance and Internal Structure of Cotton Leaves, Gossypium Hirsutum L.,
W72-05105 3F

DEPARTMENT OF ENERGY, MINES AND RESOURCES, BURLINGTON (ONTARIO). CANADA CENTRE FOR INLAND WATERS.
Organic Carbon and Nitrogen in the Surface Sediments of Lakes Ontario, Erie and Huron,
W72-05003 2H

DEPARTMENT OF MINES AND NATURAL RESOURCES, WINNIPEG (MANITOBA).
Factors Influencing Scope for Activity and Active and Standard Metabolism of Rainbow Trout (Salmo gairdneri),
W72-04958 5C

DEPARTMENT OF NATURAL RESOURCES, QUEBEC.
Detection of a Change in Runoff by an Analysis of Daily Flows,
W-72 04846 2A

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH. LOWER HUTT (NEW ZEALAND). SOIL BUREAU.
The Available-Water Capacities of North Auckland Soils,
W72-05234 2G

DESERET TEST CENTER, FORT DOUGLAS, UTAH.
Coliform Aerosols Emitted by Sewage Treatment Plants,
W72-04711 5D

DESERT INST., ASHKHABAD (USSR).
Water Balance and Regionalization of Drainage in the Turkmen SSR (Vodnyy balans i rayonirovaniye drenazha v Turkmenskoy SSR),
W72-04861 4A

DU PONT DE NEMOURS (E. I.) AND CO., WILMINGTON, DEL.
Combined High Speed Liquid Chromatography and Bioassay for the Evaluation and Analysis of an Organophosphorus Larvacide,
W72-04997 5A

DURHAM UNIV. (ENGLAND). DEPT. OF BOTANY.
The Distribution and Net Productivity of Sublittoral Populations of Attached Macrophytic Algae in an Estuary on the Atlantic Coast of Spain,
W72-04766 5C

DYNATECH CORP., CAMBRIDGE, MASS.
A Survey of Alternate Methods for Cooling Condenser Discharge Water, Total Community Considerations in the Utilization of Rejected Heat,
W72-04830 5D

EIDGENOESSISCHE ANSTALT FUER WASSERVERSORGUNG, ABWASSERREINIGUNG UND GEWAESSERSCHUTZ, ZURICH (SWITZERLAND).
Decontamination of Radioactively Poisoned Water with Peat Filters, (In German),
W72-05224 5G

EL PASO PRODUCTS CO., ODESSA, TEX.
Multiple Water Reuse,
W72-04994 5D

ELECTROCONSULT, MILAN (ITALY).
Artificial Recharge of Aquifers (Alimentation Artificielle des Nappes),
W72-05044 4B

ENGINEERING-SCIENCE, INC., TEXAS, AUSTIN.
Analytical Parameters of Petrochemical and Refinery Wastewaters,
W72-05014 5D

ENVIRONMENTAL HEALTH CENTER, OTTAWA (ONTARIO). PUBLIC HEALTH ENGINEERING DIV.
Hydrogen Isotope Ratios in a Recycling System,
W72-04967 5D

ENVIRONMENTAL PROTECTION AGENCY, BOSTON, MASS. DIV. OF WATER HYGIENE.
Trace Elements and Compounds in Waters,
W72-04969 5F

ENVIRONMENTAL PROTECTION AGENCY, CINCINNATI, OHIO. WATER QUALITY OFFICE.
Persistence of Pesticides in River Water,
W72-04922 5B

Cost of Reclamation and Mine Drainage Abatement-Elkins Demonstration Project,
W72-05146 5G

ENVIRONMENTAL PROTECTION AGENCY, DENVER, COLO. WATER QUALITY OFFICE.
The Impact of Various Heavy Metals on the Aquatic Environment,
W72-04792 5B

ENVIRONMENTAL PROTECTION AGENCY, MANASSAS, VA. ADVANCED WASTE TREATMENT RESEARCH LAB.
Nitrification and Denitrification in Activated Sludge Systems,
W72-05019 5D

ENVIRONMENTAL PROTECTION AGENCY, SAN FRANCISCO, CALIF. WATER QUALITY OFFICE.
Water Quality Office.
W72-04791 5C

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C. DIV. OF WATER HYGIENE.
The Home Groundwater Supply Picture as We See It,
W72-04950 5F

ENVIRONMENTAL PROTECTION AGENCY, WHEELING, W. VA.
Salty Ground Water and Meteoric Flushing of Contaminated Aquifers in West Virginia,
W72-04801 5B

ENVIRONMENTAL REPORTER FOUNDATION, ALBUQUERQUE, N. MEX.
* Environmental Policy: Public Participation and the Open Information System,
W72-05132 6E

FACULTES CATHOLIQUES DE LILLE (FRANCE). LAB. OF MARINE BIOLOGY.
Effect of 2 Molluscicides (Bayluscide and Frescon) on Fresh-Water Mussels: Dreissena polymorpha Pallas,
W72-05249 5C

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, WASHINGTON, D.C.
Ecology of Juvenile Tarpon and Effects of Dieldrin on Two Associated Species,
W72-04927 5C

FEDERAL WATER QUALITY ADMINISTRATION, EDISON, N.J. WATER QUALITY LAB.
Oil Spill Containment Systems.
W72-04826 5G

FEDERATION OF ROCKY MOUNTAIN STATES, INC., DENVER, COLO.
Making Water Resources Planning Relevant,
W72-04881 6B

FISH CULTURE RESEARCH STATION, DOR (ISRAEL).
Studies on Carp Nutrition: III. Experiments on the Affect on Fish Yield of Dietary Protein Source and Concentration,
W72-05266 2I

FISH CULTURE RESEARCH TRAINING INST., MALACCA (MALAYSIA).
Proximate Composition of Freshwater Fish Grass Carp, Puntius Gonionotus and Tilapia,
W72-05102 2I

FISHERIES RESEARCH BOARD OF CANADA, HALIFAX (NOVA SCOTIA). HALIFAX LAB.
Pigmentation of Brook Trout (Salvelinus fontinalis) by Feeding Dried Crustacean Waste,
W72-04756 2I

FISHERIES RESEARCH BOARD OF CANADA, NANAIMO (BRITISH COLUMBIA). BIOLOGICAL STATION.
A Hypothesis of Alternation of Age of Return in Successive Generations of Skeena River Sockeye Salmon (Oncorhynchus nerka),
W72-04755 2I

Photosynthetic Properties and Growth of Photosynthetic Sulfur Bacteria in Lakes,
W72-05085 5C

FISHERIES RESEARCH BOARD OF CANADA, VANCOUVER (BRITISH COLUMBIA). VANCOUVER LAB.
Effects of Sodium Chloride on Outgrowth and Toxin Production of Clostridium botulinum Type E in cod Homogenates,
W72-04737 5C

FISHERIES RESEARCH BOARD OF CANADA, WINNIPEG (MANITOBA). FRESHWATER INST.
Seasonal Calorific Values of Freshwater Zooplankton, as Determined with a Phillipson Bomb Calorimeter Modified for Small Samples,
W72-04912 2H

FLA. DEP. NATL. RES. MAR. RES. LAB., ST. PETERSBURG.
Thermal Addition Studies of the Crystal River Stream Electric Station,
W72-05201 5C

FLORIDA UNIV., GAINESVILLE. DEPT. OF CHEMISTRY.
Potassium Fluoride - A Reference Standard for Fluoride Ion Activity,
W72-04741 5A

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, MEXICO CITY.
Contribution of Young Fish to Total Production of Fish in the River Thames Near Reading,
W72-04721 2I

FOOD AND DRUG ADMINISTRATION, CINCINNATI, OHIO.
Collaborative Study of a Method for Multiple Chlorinated Pesticide Residues in Fish,
W72-04947 5A

FOOD AND DRUG ADMINISTRATION, WASHINGTON, D.C. DIV. OF MICROBIOLOGY.
Detection of Clostridium Botulinum Type E in Smoked Fish,
W72-04745 5A

FOREST SERVICE (USDA), DURHAM, N.H. NORTHEASTERN FOREST EXPERIMENT STATION.
Effect of Elimination of Vegetation on Stream Water Quantity and Quality,
W72-05076 3B

Forest Transpiration Reduction by Clearcutting and Chemical Treatment,
W72-05077 2D

Changes in Snowmelt Runoff After Forest Clearing on a New England Watershed,
W72-05078 4A

Spatial Variation of Net Radiation, Albedo and Surface Temperature of Forests,
W72-05079 2D

New Landmark in the White Mountains,
W72-05080 2A

FOREST SERVICE (USDA), SYRACUSE, N.Y.
Annual Soil Moisture-Temperature Patterns as Influenced by Irrigation,
W72-05137 2G

FREIBURG UNIV. (WEST GERMANY). BICHEMISCHES INSTITUT.
Energy Production in Anaerobic Organisms,
W72-05018 5D

FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (ENGLAND).
Life Histories and Drifting of Three Species of Limnephilidae (Trichoptera),
W72-04714 5A

An Artificial Alteration of the Seasonal Cycle of the Plankton Diatom Melosira Italica Subsp Subarctica in an English Lake,
W72-04765 5C

FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (ENGLAND).

The Distances Travelled by Drifting Invertebrates in a Lake District Stream,
W72-05274 2I

FRESHWATER BIOLOGICAL ASSOCIATION, AMBLESIDE (SWEDEN).
Vertical Distribution of Some Ciliated Protozoa in Two Freshwater Sediments,
W72-04718 5C

FRESHWATER BIOLOGICAL ASSOCIATION, WAREHAM (ENGLAND). RIVER LAB.
The Food of the Grayling Thymallus thymallus (L.) of the River Lugg., Herefordshire,
W72-04712 2I

GEOLOGICAL SURVEY, AUSTIN, TEX.
Records of Wells, Drillers' Logs, and Chemical Analysis of Ground Water in Galveston County, Texas 1952-1970,
W72-04795 4B

Relation of Ponded Floodwater from Hurricane Beulah to Ground Water in Kleberg, Kenedy, and Willacy Counties, Texas,
W72-04796 2F

GEOLOGICAL SURVEY, BISMARCK, N. DAK.
Thermal Study of the Missouri River in North Dakota Using Infrared Imagery,
W72-04824 5B

GEOLOGICAL SURVEY, BOISE, IDAHO.
Ground-Water Levels in Idaho, 1971.
W72-04819 4B

Ground-Water Pumpage from the Snake Plain Aquifer, Southeastern Idaho,
W72-04820 4B

GEOLOGICAL SURVEY, CHARLESTON, W. VA. WATER RESOURCES DIV.
Records of Wells, Springs, and Test Borings, Chemical Analyses of Water, Sediment Analyses, Standard Streamflow Data Summaries, and Selected Drillers' Logs From The Little Kanawha River Basin in West Virginia,
W72-04841 7C

GEOLOGICAL SURVEY, COLUMBUS, OHIO.
Floods of July 4-8, 1969 in North-Central Ohio,
W72-04852 2E

GEOLOGICAL SURVEY, DENVER, COLO.
Determination of Tritium in Water by the U.S. Geological Survey, Denver, Colorado,
W72-04842 5A

Hydrologic Data for the San Luis Valley, Colorado,
W72-05025 7C

GEOLOGICAL SURVEY, LITTLE ROCK, ARK. WATER RESOURCES DIV.
Hydrologic Data for Horseshoe Lake, Arkansas, and Vicinity,
W72-04822 7C

GEOLOGICAL SURVEY, MADISON, WIS.
Floods on Yahara River, Lake Kegonsa Dam to County Line, Dane County, Wisconsin,
W72-04815 4A

GEOLOGICAL SURVEY, MADISON, WIS. WATER RESOURCES DIV.
Water Resources Data for Wisconsin, 1969: Part 1. Surface Water Records, and Part 2. Water Quality Records.
W72-05094 7C

GEOLOGICAL SURVEY, MENLO PARK, CALIF. WATER RESOURCES DIV.
Water Chemistry of the Santa Clara Valley, California,
W72-04835 2K

Descriptions and Chemical Analyses for Selected Wells in the Dos Palos-Kettleman City area, San Joaquin Valley, California,
W72-04843 2K

GEOLOGICAL SURVEY, MIAMI, FLA. WATER RESOURCES DIV.
Organochlorine Insecticide Residues in Everglades National Park and Loxahatchee National Wildlife Refuge, Florida,
W72-04799 5B

GEOLOGICAL SURVEY, MINEOLA, N.Y.
Catalog of Recharge Basins on Long Island, N.Y., In 1969,
W72-04833 4A

GEOLOGICAL SURVEY, PARKVILLE, MD. WATER RESOURCES DIV.
Progress Report on the Analog Model Study of the Magothy Aquifer in the Annapolis, Maryland Area.
W72-04840 4B

GEOLOGICAL SURVEY, SACRAMENTO, CALIF.
Estimated Subsidence in the Raymond Basin, Los Angeles County, California, for a Postulated Water-Level Lowering, 1970-2020,
W72-04823 4B

GEOLOGICAL SURVEY, TACOMA, WASH.
Municipal, Industrial, and Irrigation Water Use in Washington, 1970,
W72-04816 6D

GEOLOGICAL SURVEY, WASHINGTON, D.C.
A Flood-Frequency Relation Based on Regional Record Maxima,
W72-04797 2E

Hydrology of Hungry Horse Reservoir, Northwestern Montana,
W72-04821 4A

Application of Galerkin's Procedure to Aquifer Analysis,
W72-05032 2F

GEORGIA UNIV., ATHENS. SCHOOL OF FOREST RESOURCES.
Comments on the Catchment Experiment to Determine Vegetal Effects on Water Yield,
W72-04954 3B

GHANA FISH DEPT., AKOSOMBO.
Age, Growth and Condition of Black Crappie, Pomoxis nigromaculatus (Le Sueur), in Lewis and Clark Lake, South Dakota, 1954 to 1967,
W72-05264 2H

GHENT RIJKSUNIVERSITEIT (BELGIUM). ASTRONOMICAL OBSERVATORY AND SEMINAR OF THE THEORY OF PROBABILITIES AND MATHEMATICAL STATISTICS.
A Truncated Square-Root-Normal Distribution Applied to Monthly Precipitation Totals for Ghent (Belgium),
W72-05048 2B

GHENT RIJKSUNIVERSITEIT (BELGIUM). GEOLOGISCH INSTITUUT.
Resistivity Soundings in the Condroz (Belgium) With Schlumberger and Dipole Arrays; Application to Limestone Aquifer Evaluation,
W72-04850 2F

GLASGOW UNIV. (SCOTLAND). DEPT. OF PHYSIOLOGY.
Natural Hybrids of the African Cichlid Fishes Tilapia spirlurus nigra and T. leucosticta: A Case of Hybrid Introgression,
W72-05270 2I

GOSUDARSTVENNYI NAUCHNO-ISSLEDVATELSKII INSTITUT OZERNOGO I RECHNOGO RYBNOGO KHOZYAISTVA, LENINGRAD (USSR).
An Analysis of the Fauna of Humic Lakes With Respect to Their Typology, (In Russian),
W72-05206 5C

GREATER MANASSAS SANITARY DISTRICT, PRINCE WILLIAM COUNTY, VA.
Phosphorus Removal by Luxury Uptake,
W72-05011 5D

GREATER PEORIA SANITARY AND SEWAGE DISPOSAL DISTRICT, ILL.
Redesigning Existing Facilities to Increase Hydraulic and Organic Loading,
W72-05004 5D

GRENOBLE UNIV. (FRANCE). LABORATOIRES DE MECANIQUE DES FLUIDES.
Problems Raised by the Application of Stochastic Relations to Hydrologic Variables and Means of Their Solution (Problemes souleves par l' application des relations stochastiques aux variables hydrologiques et moyens de les resoudre),
W72-04847 2A

GULF GENERAL ATOMIC, INC., SAN DIEGO, CALIF.
Evaluation Criteria for Granular Activated Carbons,
W72-04977 5D

HARVARD-MIT JOINT CENTER FOR URBAN STUDIES, CAMBRIDGE, MASS.
Planning for People, Not Buildings,
W72-05133 6B

HARVARD UNIV., CAMBRIDGE, MASS. CENTER FOR POPULATION STUDIES.
Algebraic Technological Function from a Simulation Model,
W72-05034 6A

HARVARD UNIV., CAMBRIDGE, MASS. DEPT. OF GEOLOGICAL SCIENCES.
Geochemical Mass Balance Among Lithosphere, Hydrosphere, and Atmosphere,
W72-04814 2K

HARVARD UNIV., CAMBRIDGE, MASS. DIV. OF ENGINEERING AND APPLIED PHYSICS.
Application of Stream Order Numbers to the Merrimack River Basin,
W72-05036 4A

HAWAII STATE DEPT. OF PLANNING AND ECONOMIC DEVELOPMENT, HONOLULU.
Information Requirement for Socio-Ecological Models,
W72-05119 6A

HAWAII UNIV., HONOLULU. DEPT. OF ZOOLOGY.
Ecologic Observations on an Estuarine Environment at Fanning Atoll,
W72-05213 2L

HEBREW UNIV., REHOVOTH (ISRAEL). DEPT. OF SOIL SCIENCE.
Election Micrographs of Lake Kinneret Sediments,
W72-04810 2J

HEBREW UNIV., REHOVOTH (ISRAEL). FACULTY OF AGRICULTURE.
Effects of Soil Moisture Stress on Two Varieties of Upland Cotton in Israel: I. The Coastal Plain Region,
W72-05179 3F

HITACHI LTD., TOKYO (JAPAN). HITACHI WORKS.
Single-Stage, 500 M High-Head Reversible Pump-Turbines and Generator-Motors for Numappara Power Station,
W72-04867 8C

Field Test Results on Diagonal-Flow Type Reversible Pump-Turbines and Generator-Motors for Takane No. 1 Power Station,
W72-04868 8C

HOUSE, WASHINGTON, D.C.
A National Policy for Western Water Development,
W72-04895 6B

HULL UNIV. (ENGLAND). DEPT. OF BOTANY.
Oxygen Diffusion from the Roots of Rice Grown Under Non-Waterlogged Conditions,
W72-05245 3F

HYDROBIOLOGICAL RESEARCH STATION, MADRAS (INDIA).
Shallow Aquatic Biotopes as Limnological Models,
W72-05023 5C

IDAHO UNIV., MOSCOW. WATER RESOURCES RESEARCH INST.
Effects of Siltation and Coarser Sediments on Distribution and Abundance of Stream-Inhabiting Insects,
W72-05024 5C

ILLINOIS STATE GEOLOGICAL SURVEY, URBANA.
Farmdalian Lake Deposits and Faunas in Northern Illinois,
W72-04834 2H

ILLINOIS STATE UNIV., NORMAL. DEPT. OF BIOLOGICAL SCIENCE.
Natural Hybridization and Reproductive Ecology of Two Toad Species in a Disturbed Environment,
W72-05117 2I

ILLINOIS UNIV., URBANA; AND IOWA STATE UNIV., AMES; AND NORTH CAROLINA STATE UNIV., RALEIGH.
The Formation of Nitrate from Ammonium Nitrogen in Soils: IV. Use of the Delay and Maximum Rate Phases for Making Quantitative Predictions,
W72-05120 5B

ILLINOIS UNIV., URBANA. DEPT. OF BOTANY.
Recovery of Photosynthesis in Sunflower After a Period of Low Leaf Water Potential,
W72-05243 2I

ILLINOIS UNIV., URBANA. DEPT. OF METALLURGY AND MINING ENGINEERING.
Statistical Geometry of Porous Media,
W72-04783 2G

INDIAN AGRICULTURAL RESEARCH INST., NEW DELHI.
Agricultural Research: Progress, Problems and Prospects,
W72-05184 3F

INDIAN INST. OF TECH., KHARAGPUR.
Effects of Depth of Submergence, Fertilization and Cultivation on Water Requirement and Yield of Rice,
W72-05190 3F

INDIANA UNIV., BLOOMINGTON. DEPT. OF POLITICAL SCIENCE.
Environmental Policy in a Hypertrophic Society,
W72-04938 6B

INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE: 149, RUE DE GRENELLE, PARIS-7.
Annales D'Hydrobiologie.
W72-05251

INSTITUT ROYAL DES SCIENCES NATURELLES DE BELGIQUE, BRUSSELS.
Limnological Studies in Belgium: VI. The Meanders of the Durme River at Hamme (East Flanders Province),
W72-05210 5A

Mollusca and Cladocera of the 'Ven Gorigemberg', Dystrophic Marshes of the Campine Limbourgeoise,
W72-05212 2L

Limnological Studies in Belgium: VII. Two Ponds at Notmeir (Anvers Province). A. Environmental Study,
W72-05214 5C

Limnological Studies in Belgium: VII. Two Ponds at Notmeir (Anvers Province): B. Phytoplanktonic Considerations. C. Conclusions,
W72-05215 5C

INSTITUTE OF BIOLOGY OF THE SOUTHERN SEAS, SEVASTOPOL (USSR).
Strontium-90, Strontium and Calcium in some Aquatic Organisms from the Sea of Okhotsk, (In Russian),
W72-04999 5A

Quantitative Characterization of the Means of Strontium-90 Intake into the Body of Gastropods, (In Russian),
W72-05227 5A

INSTITUTE OF MEDICAL PARASITOLOGY AND TROPICAL MEDICINE, MOSCOW (USSR).
Characteristics of the Epidemiology of Diphyllobothriasis in Some Lake Areas in Buryatia, (In Russian),
W72-05225 5C

INSTITUTO DE INVESTIGACIONES PESQUERAS, CADIZ (SPAIN).
Phytoplankton and Hydrography of the Bay of Cadiz in 1969, (In Spanish),
W72-05254 5A

A Contribution to the Knowledge of Reproduction in the Oyster, Crassostrea angulata (LMK.), in the Estuary of the Guadalquivir, (In Spanish),
W72-05257 2L

INSTITUTO DE PESQUISAS DA MARINHA, RIO DE JANEIRO (BRAZIL).
Biological Observations on Sardinella aurita: A. Stomach Contents (In Portuguese),
W72-05193 2I

INSTITUTO DI ZOOLOGIA. ROME UNIV. (ITALY).
Ianula: An Account of the History and Development of the Lago Di Monterosi, Latium, Italy: IV. Present Ecological Conditions in the Lake,
W72-05208 5C

INSTITUTUL AGRONOMIC, BUCHAREST (RUMANIA).
A Study of the Influence of Nitrogen and Phosphorus Fertilizers on the Corn Grown on the Alluvial Soils of the Danube Flooded Area,
W72-05116 2G

A Study of the Variation of Water Level and Mineralization of the Ground Water in the Danube Drainage Area 'Boianu-Sticlenau' (In Rumanian),
W72-05169 5C

INTERNATIONAL LAND DEVELOPMENT CONSULTANTS, ARNHEM (NETHERLANDS).
The Tana Irrigation Scheme: An Integrated Development Project,
W72-05252 3F

INTERNATIONAL PACIFIC SALMON FISHERIES COMMISSION, CULTUS LAKE (BRITISH COLUMBIA).
Toxicity and Oxygen Demand of Decaying Bark,
W72-04957 5C

IOWA AGRICULTURAL EXPERIMENT STATION, AMES.
Farm Animal-Waste Management,
W72-04908 5G

IOWA STATE UNIV., AMES. DEPT. OF AGRONOMY.
Special Meteorological Data Needs for Agriculture,
W72-05183 2B

IOWA STATE UNIV., AMES. DEPT. OF CIVIL ENGINEERING.
Advanced Organics Removal by Pulsed Adsorption Beds,
W72-05005 5D

IOWA UNIV., IOWA CITY. STATE HYGIENIC LAB.
Dieldrin Levels in Fish From Iowa Streams,
W72-04739 5A

Chlorinated Hydrocarbon Pesticides in Iowa Rivers,
W72-04753 5B

JACKSONVILLE, ARK.
Biological Treatment of Chlorophenolic Wastes.
W72-04825 5D

JOHN HOPKINS UNIV., BALTIMORE, MD. CHESAPEAKE BAY INST.
Results of a Field Study Using the 3-Axis Doppler Shift Current Meter,
W72-04817 2L

JOHNS HOPKINS UNIV., BALTIMORE, MD. CHESAPEAKE BAY INST.
The Chesapeake Bay Institute Wave Follower--Part II,
W72-04818 7B

Volumetric, Areal, and Tidal Statistics of The Chesapeake Bay Estuary and Its Tributaries,
W72-04838 2L

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF GEOGRAPHY AND ENVIRONMENTAL ENGINEERING.
Effects of Carbonate and Magnesium on Calcium Phosphate Precipitation,
W72-04949 5D

JOHNS HOPKINS UNIV., BALTIMORE, MD. SCHOOL OF HYGIENE AND PUBLIC HEALTH.
Amoebic Cysticidal Properties of Halogens in Water,
W72-04746 5F

JOHNS-MANVILLE CORP., NEW YORK.
Waste Water Treatment Phosphate Removal by Iron Oxide,
W72-05041 5D

KANSAS CITY DEPT. OF WATER AND POLLUTION CONTROL, MO.
Polymers in the Filtration of Raw Sludge,
W72-04968 5D

KANSAS STATE GEOLOGICAL SURVEY, LAWRENCE.
Effects of Urbanization on Storm Water Runoff Quality: A Limited Experiment, Naismith Ditch, Lawrence, Kansas,
W72-05035 4C

KANSAS UNIV., LAWRENCE. DEPT. OF GEOGRAPHY.
Cluster Analysis of Non-Insect Macro-invertebrates of the Upper Potomac River,
W72-05134 5C

KANSAS UNIV., LAWRENCE. DEPT. OF MECHANICS AND AEROSPACE ENGINEERING.
Runoff from Impervious Surfaces,
W72-04844 4C

KANSAS WATER RESOURCES RESEARCH INST., MANHATTAN.
Numerical Modeling of Unsaturated Groundwater Flow Including Effects of Evapotranspiration,
W72-05089 2G

KARLOVA UNIVERSITA, (CZECHOSLOVAKIA). LAB. OF ICHTHYLOGY.
Growth of Chondrostoma nasus (Linnaeus, 1758) in Dunajec and Raba of the Upper Vistula River System,
W72-05263 2I

KEMPAS DEVON ESTATE, MALACCA (MALAYSIA).
Preliminary Studies on the Composition of Major Ions of Some Fish Ponds of Malacca in Malaysia,
W72-05107 2H

KENT UNIV., CANTERBURY (ENGLAND). FACULTY OF SOCIAL SCIENCES.
Urban Social Theory and Research,
W72-05121 6B

KENTUCKY UNIV., LEXINGTON. DEPT. OF AGRONOMY.
Influence of No-Tillage on Soil Moisture,
W72-05155 2G

KIEL UNIV. (WEST GERMANY). INSTITUT FUER PFLANZENERNAEHRUNG UND BODENKUNDE.
Contributions to the Genesis and Classification of Marsh Soils: II. On the Sulphur Metabolism of Muds and Salt Marshes, (In German),
W72-04924 2G

KISHAU DAM PLANNING DIV., DEHRA DUN (INDIA).
Peaking-Station Layouts on Himalayan Rivers,
W72-04875 4A

KYOTO UNIV. (JAPAN). FACULTY OF SCIENCE.
Social Behaviour and Production of Ayu-Fish in the River Ukawa Between 1955 and 1969, with Reference to the Stability of its Territoriality (In Japanese),
W72-05176 2I

KYOTO UNIV. (JAPAN). RESEARCH INST. FOR FOOD SCIENCE.
Microbiological Studies on Nigrogen Cycle in Aquatic Environments: I. Effect of Oxygen Tension on Microflora and Balance of Nitrogeneous Compounds in the Experimental Aquarium.
W72-05164 5C

LAGOS UNIV. (NIGERIA). SCHOOL OF BIOLOGICAL SCIENCE.
The Food and Feeding Habits of Tilapia Species in the Lagos Lagoon,
W72-04705 2L

LEAGUE OF WOMEN VOTERS, WASHINGTON, D.C.
Improving the Planning Process--Establishing Values,
W72-04888 6B

LIMNOLOGICHESKII INSTITUT, IRKUTSK (USSR).
Seasonal Meteorological Conditions in the Region of the Bratsk Reservoir (Sezonnyye meteorologicheskiye usloviya v rayone Bratskogo vodokhranilishcha),
W72-04854 2H

Formation of Phytoplankton in the Bratsk Reservoir (Formirovaniye fitoplanktona Bratskogo vodokhranilishcha),
W72-04855 5C

Aquatic Bacteria in the Bratsk Reservoir in 1965 (Bakterioplankton Bratskogo vodokhranilishcha v 1965 g.),
W72-04856 2H

Fish Population and Distribution in the Oka River Section of the Bratsk Reservoir (Razmeshcheniye i chislennost' ryb v Okinskoy chasti Bratskogo vodokhranilishcha),
W72-04858 2H

LITTLETON RESEARCH AND ENGINEERING CORP., MASS.
An Engineering-Economic Study of Cooling Pond Performance.
W72-04831 5D

LIVERPOOL UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Flow Over Rounded Spillways,
W72-04809 8B

LOUISIANA STATE UNIV., BATON ROUGE. COASTAL STUDIES INST.
Wind Stress Criteria in Eolian Sand Transport,
W72-05037 2J

LOUVAIN UNIV. (BELGIUM).
The Effect of Water Activity on Ion Exchange Selectivity in Clays,
W72-05135 2G

LUND UNIV. (SWEDEN). LIMNOLOGICAL INST.
Primary Production and Chlorophyll a Content of Nanoplankton in a Eutrophic Lake,
W72-04717 5C

MAINE UNIV., ORONO. DEPT. OF CIVIL ENGINEERING.
Abatement of Pollution From a Poultry Processing Plant,
W72-05006 5D

MAINE UNIV., WALPOLE. IRA C. DARLING CENTER FOR RESEARCH, TEACHING AND SERVICE.
Setting of the American Oyster Related to Environmental Factors and Larval Behavior,
W72-04941 5C

MANHATTAN COLL., BRONX, N.Y. ENVIRONMENTAL ENGINEERING AND SCIENCE PROGRAM.
Recurrence Relations for First Order Sequential Reactions in Natural Waters,
W72-05027 5B

MARINE DEPT., WELLINGTON (NEW ZEALAND). FISHERIES RESEARCH DIV.
The Annual Temperature Regime of a Small Stream in New Zealand,
W72-04987 2E

MARINE LAB., ABERDEEN (SCOTLAND).
Studies on Tellina Tenuis Da Costa: III. Aspects of General Biology and Energy Flow,
W72-05112 2L

MARYLAND UNIV., COLLEGE PARK. DEPT. OF ZOOLOGY.
Moisture as a Factor Influencing the Distribution of Two Species of Terrestrial Salamanders,
W72-05154 2I

MARYLAND UNIV., LA VALE. NATURAL RESOURCES INST.
Histological Comparisons of the Adrenal-Cortical Cells of Hatchery and Wild Landlocked Atlantic Salmon (Salmo salar),
W72-04960 5C

MARYLAND UNIV., PRINCE FREDERICK. NATURAL RESOURCES INST.
Photographic Method for Surveying Clam Populations,
W72-04750 7B

MARYLAND UNIV., SOLOMONS. NATURAL RESOURCES INST.
Daylight Incubator Estimates of Primary Production in the Mouth of the Patuxent River, Maryland,
W72-04904 2L

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. RALPH M. PARSONS LAB. FOR WATER RESOURCES AND HYDRODYNAMICS.
A Modular Distributed Model of Catchment Dynamics,
W72-04896 2E

Evaluation of Radar and Raingage Systems for Flood Forecasting,
W72-04966 2B

MASSACHUSETTS UNIV., AMHERST. WATER RESOURCES RESEARCH CENTER.
A Computerized Educational Program for the Application of the Management Sciences to Water Resource Management,
W72-05088 7C

The Mill River and Its Floodplain in Northampton and Williamsburg, Mass.: A Study of the Vascular Plant Flora, Vegetation, and the Presence of the Bacterial Family Pseudomonadaceae in Relation to Patterns of Land Us e,
W72-05092 5C

MAX-PLANCK-INSTITUT FUER LIMNOLOGIE ZU PLOEN (WEST GERMANY).
Ecology of Freshwater Fishes in Amazonia: Present State of Knowledge and Future Problems, (In German),
W72-05277 2I

MELBOURNE UNIV. (AUSTRALIA). DEPT. OF GEOGRAPHY.
The Disappearing Mitchell Dekta,
W72-05156 4D

METCALF AND EDDY, INC., BOSTON, MASS.
ABCs of Cultural Eutrophication and Its Control. Part I--Cultural Changes,
W72-04769 5C

METEOROLOGISCHER DIENST DER DEUTSCHEN DEMOKRATISCHEN REPUBLIK, BERLIN. FORSCHUNGSINSTITUT FUER HYDROMETEOROLOGIE.
Some Results of Hydromteorological Research Work Carried Out in The Experimental Basins of the Meteorological Service of German Democratic Republic,
W72-05046 2A

MIAMI UNIV., OXFORD, OHIO. DEPT. OF ZOOLOGY; AND MIAMI UNIV., OXFORD, OHIO. DEPT. OF PHYSIOLOGY.
Intraseasonal Changes in Caloric Content of Some Freshwater Invertebrates,
W72-04722 2I

MICHIGAN STATE UNIV., EAST LANSING. AGRICULTURAL EXPERIMENT STATION.
Poultry Pollution: Research Results,
W72-05058 5E

MICHIGAN STATE UNIV., EAST LANSING, DEPT. OF AGRICULTURAL ENGINEERING.
Drying of Poultry Manure in a Cage-Layer House,
W72-05063 5E

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF ANIMAL HUSBANDRY.
Dried Poultry Waste as a Protein Source for Feedlot Cattle,
W72-05064 5E

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF DAIRY SCIENCE.
Feeding Dehydrated Poultry Waste to Dairy Cows,
W72-05061 5E

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF FISHERIES AND WILDLIFE.
An Automatic Brine Shrimp Feeder,
W72-04751 7B

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF POULTRY SCIENCE.
Early Experiments at Michigan State University Involving the Use of Chicken Manure,
W72-05059 5E

Economics of Dried Poultry Waste (DPW) as a Feed Ingredient or a Fertilizer,
W72-05060 5E

The Relationship of Drying Temperature to Total Crude Protein in Dried Poultry Waste,
W72-05062 5E

The Metabolizeable Energy Value of Dried Poultry Waste,
W72-05065 5E

The Effects of Continually Recycling Dehydrated Poultry Wastes (DPW) on the Performance of SCWL Laying Hens -- A Preliminary Report,
W72-05066 5E

MICHIGAN UNIV., ANN ARBOR.
The Importance of Ecological Studies as a Basis for Land-Use Planning,
W72-04936 6B

MINISTRY OF AGRICULTURE, CAIRO (EGYPT).
Effect of 2-Chloro-Ethyltrimethyl-Ammonium Chloride (CCC) and Urea on Shedding of Young Bolls and Yield of Cotton Plants Under Frequent and Infrequent Irrigation,
W72-05229 3F

MINISTRY OF AGRICULTURE, CAIRO (EGYPT). VETERINARY RESEARCH INST.
Utilization of Water Hyacinth as an Organic Manure with Special Reference to Water-Borne Helminths,
W72-05115 5F

MINISTRY OF HEALTH, TEL-AVIV (ISRAEL). PUBLIC HEALTH LAB.
A Convenient Method for Isolation of Salmonellae from Sewage and Contaminated Sea Water,
W72-04919 5D

MINISTRY OF WORKS, WELLINGTON (NEW ZEALAND). WATER AND SOIL DIV.
Effects of Random Data Errors on the Parameter Values for a Conceptual Model,
W72-05029 7A

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF ECOLOGY AND BEHAVIORAL BIOLOGY.
Properties of Some Natural Waters in a Tropical Wet Forest of Costa Rica,
W72-05194 2K

MINNESOTA UNIV., ST. PAUL.
Diel Patterns of Aquatic Invertebrate Drift in Streams of Northern Utah,
W72-05275 2I

MINNESOTA UNIV., ST. PAUL. DEPT. OF ENTOMOLOGY, FISHERIES AND WILDLIFE.
Survival and Hatching of Walleye Eggs at Various Dissolved Oxygen Levels,
W72-04935 5C

MISSOURI RIVER BASIN ANIMAL WASTE MANAGEMENT, KANSAS CITY, MO. PILOT (STEERING) TASK GROUP.
Feedlot Waste Management.
W72-04965 5E

MONTANA STATE UNIV., BOZEMAN.
Water Resources Development,
W72-04880 6B

MONTANA UNIV., MISSOULA.
Public Participation and Environmental Quality,
W72-04839 6A

MORGAN STATE COLL., BALTIMORE, MD. DEPT. OF BIOLOGY.
Anatomical Changes in the Shoot Tip of Wheat After Exposure to Drought Stress,
W72-05153 3F

MUSEE NATIONAL, BRUNOY (FRANCE).
Importance of the Maximal Hygroscopic Point in a Factorial Analysis of the Biotope of Collembolans (In French),
W72-05178 2G

NAPLES ZOOLOGICAL STATION (ITALY).
Hydrographic Research Studies of Corona Del Lago Fusaro (Naples), (In Italian),
W72-05255 2L

NASSAU COUNTY DEPT. OF PUBLIC WORKS, N. Y.
Water Conservation by Reclamation and Recharge,
W72-05140 5D

NATAL UNIV., PIETERMARITZBURG (SOUTH AFRICA).
A Note on Inexpensive Telemetry of River Sediment Concentrations,
W72-05049 7B

NATIONAL AGRICULTURAL ADVISORY SERVICE, ABERYSTWYTH (WALES).
An Ecological Study of the Psychrotrophic (SIC) (Psychrophilic) Bacteria of Soil, Water, Grass and Hay,
W72-05158 5B

NATIONAL ENVIRONMENTAL RESEARCH CENTER, CINCINNATI, OHIO. ANALYTICAL QUALITY CONTROL LAB.
Methods for Chemical Analysis of Water and Wastes, 1971.
W72-04735 5A

Determination of Nitrilotriacetic Acid by High-Speed Ion Exchange Chromatography,
W72-04901 5A

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA); AND COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH PRETORIA (SOUTH AFRICA).
A Colorimetric Method for Ammonia in Natural Waters,
W72-04964 5A

NATIONAL INSTITUTE FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).
Anaerobic Digestion II. The Characterization and Control of Anaerobic Digestion,
W72-04995 5D

NATIONAL MARINE FISHERIES SERVICE, GALVESTON, TEX. BIOLOGICAL LAB.
Setting, Growth and Mortality of Crassostrea virginica in a Natural Marsh and a Marsh Altered by a Housing Development,
W72-04940 5C

NATIONAL MARINE FISHERIES SERVICE, OXFORD, MD. BIOLOGICAL LAB.
Percentage of Solids and Length-Weight Relationship of the Ocean Quahog,
W72-04744 2I

A Parasite and Disease Survey of Connecticut Oysters,
W72-04939 5C

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WASH.
Effects of Increased Temperature on Cold-Water Organisms,
W72-04764 5C

NATIONAL MARINE WATER QUALITY LAB., WEST KINGSTON, R.I.
Removal of Trace Metals From Marine Culture Media,
W72-04708 5A

Histological and Hematological Responses of an Estuarine Teleost to Cadmium,
W72-04709 5C

Advances in the Continuous Culture of Planktonic Copepods,
W72-04900 5A

NATIONAL OCEAN SURVEY, WASHINGTON, D.C.
Wire-Guided Self-Propelled Water Sampler.
W72-05042 7B

NATIONAL VEGETABLE RESEARCH STATION, WELLESBOURNE (ENGLAND).
Breeding of Maize for Low Rainfall Areas of Kenya: I. The Reliability of Yield of Early and Later Maturing Maizes,
W72-04916 3F

NATIONAL WATER COMMISSION, ARLINGTON, VA.
Administrative Allocation of Water,
W72-04786 6E

A New Look at National Water Policy,
W72-04882 6B

Legal Aspects of Water Salvage,
W72-05098 6E

Legal Protection of Instream Water Values,
W72-05099 6E

Public Access Rights in Waters and Shorelands,
W72-05100 6E

NATIONAL WATER RESOURCES ASSOCIATION, WASHINGTON, D.C.
The Third Western Interstate Water Conference of Colorado State University,
W72-04886 6B

NATIONAL WILDLIFE FEDERATION, WASHINGTON, D.C.
Water Resources Planning,
W72-04885 6B

NAUCHNO-ISSLEDOVATELSKII INSTITUT GIGIENY, MOSCOW (USSR).
Water Quality of the Bratsk Reservoir During the First Years of Impoundment, 1962-64 (Sanitarnoye sostoyaniye Bratskogo vodokhranilishcha v pervyye gody yego zapolneniya (1962-1964 gg.)),
W72-04860 5C

NEBRASKA UNIV., LINCOLN.
Eutrophication of Small Reservoirs in the Great Plains,
W72-04761 5C

The Effects of Electrokinetics Upon Incrustation in Water Wells,
W72-04870 8A

NEBRASKA UNIV., LINCOLN. DEPT. OF CIVIL ENGINEERING; AND NEBRASKA UNIV., LINCOLN. DEPT. OF ZOOLOGY.
Eutrophication of Small Reservoirs in the Great Plains,
W72-04759 5C

NEPTUNE MICROFLOC, INC., CORVALLIS, OREG.
Recent Experiences in Plant-Scale Application of the Settling Tube Concept,
W72-04991 5D

NEW MEXICO STATE UNIV., UNIVERSITY PARK. WATER RESOURCES RESEARCH INST.
The Reuse of Water in Manufacturing: An Explanatory Economic Model with Data Analysis,
W72-05093 3E

NEW MEXICO UNIV., ALBUQUERQUE. PROGRAM FOR ADVANCED STUDY IN PUBLIC SCIENCE POLICY AND ADMINISTRATION.
Environmental Policy and Politics: Value and Power Context,
W72-04985 6B

NEW YORK CITY ENVIRONMENTAL PROTECTION ADMINISTRATION. DEPT. OF WATER RESOURCES.
Toxic Effects of Ammonia Nitrogen in High-Rate Digestion,
W72-05015 5D

NEW YORK UNIV., N.Y. SCHOOL OF ENGINEERING AND SCIENCE.
Analysis of Turbulent Pipe Flow,
W72-05050 8B

NEWARK STATE COLL., UNION, N.J.
Glacial Lake Passaic: Palynological Evidence for Draining of the Great Swamp Stage,
W72-05200 2H

NEWCASTLE-UPON-TYNE UNIV. (ENGLAND).
Ecology and Technology in Twentieth-Century Landscapes,
W72-04980 6B

NORTH CAROLINA STATE UNIV., RALEIGH. DEPT. OF BIOLOGICAL AND AGRICULTURAL ENGINEERING; AND NORTH CAROLINA STATE UNIV., RALEIGH. DEPT. OF CIVIL ENGINEERING.
Algal-Bacterial Symbiosis for Removal and Conservation of Wastewater Nutrients,
W72-04983 5D

NORTH CAROLINA UNIV., CHAPEL HILL. SCHOOL OF PUBLIC HEALTH.
Ecology and Man, The Dilemma of Our Technological Culture,
W72-05084 6B

NORTH CAROLINA UNIV., MOREHEAD CITY. INST. OF MARINE SCIENCE.
A Ten-Year Study of Meroplankton in North Carolina Estuaries: Annual Occurrence of Some Brachyuran Developmental Stages,
W72-04903 2L

NORTH DAKOTA STATE UNIV., FARGO. DEPT. OF AGRICULTURAL ENGINEERING AND ANIMAL SCIENCE.
Handling Livestock Waste,
W72-05057 5D

NORTH DAKOTA STATE UNIV., FARGO. DEPT. OF BACTERIOLOGY.
Bacterial Counts of a Section of the Red River -- Summer, 1970,
W72-05056 5A

NORTHEASTERN WATER HYGIENE LAB., NARRAGANSETT, R.I.
The Elimination of Bacteria by the Northern Quahog: Variability in the Response of Individual Animals and the Development of Criteria,
W72-04944 5C

Seasonal Factors Relevant to Coliform Levels in the Northern Quahaug,
W72-04945 5C

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF BOTANY.
Some Further Observations on Protein Fractions Isolated from Wheat Leaves Subjected to Moisture Stress,
W72-05106 3F

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF CIVIL ENGINEERING.
Operational Stability of the Extended Aeration Process,
W72-04784 5D

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF ZOOLOGY.
Some Observations on the Limnology of a Pond Receiving Animal Wastes,
W72-04773 5C

OLIN CORP., NEW HAVEN, CONN.
The Analysis of Mercury in Urine, Blood, Water, and Air,
W72-05113 5A

OREGON STATE UNIV., CORVALLIS. DEPT. OF CIVIL ENGINEERING.
A New Concept in Sample Preservation--Poisoning and Depoisoning,
W72-05012 5A

OREGON STATE UNIV., CORVALLIS. DEPT. OF FISHERIES AND WILDLIFE.
Population Dynamics of Selected Zooplankton in Three Oligotrophic Oregon Lakes,
W72-04763 5C

OREGON STATE UNIV., CORVALLIS. DEPT. OF OCEANOGRAPHY.
Nutrients and Carbon Dioxide in the Columbia River,
W72-04974 5B

OREGON STATE UNIV., CORVALLIS. WATER RESOURCES RESEARCH INST.
Temperature Requirements of Salmonids in Relation to their Feeding, Bioenergetics, Growth, and Behavior.
W72-05090 5C

OTAGO UNIV., DUNEDIN (NEW ZEALAND). DEPT. OF CHEMISTRY.
Complexes of Halloysite with Organic Compounds,
W72-05043 2K

OTTAWA UNIV. (ONTARIO). DEPT. OF BIOLOGY.
A Quantitative Sampler for Aquatic Phytomacrofauna,
W72-04710 5A

Intraspecific Variations and Postglacial Distribution of Lake Char (Salvelinus namaycush),
W72-04913 2H

PACIFIC NORTHWEST WATER LAB., CORVALLIS, OREG.
Guidelines: Biological Surveys at Proposed Heat Discharge Sites,
W72-04828 5G

PADUA UNIV. (ITALY). ISTITUTO DI BIOLOGIA ANIM.
Ecological Considerations of the Animal Population of the Lagabrun Peat-Bog,
W72-05181 2H

Ecological Considerations of the Animal Population of the Santo Lake of Cembra,
W72-05205 2H

PADUA UNIV. (ITALY). ISTITUTO DI ELETTROTECNICA E DI ELETTRONICA; AND CENTRO VENETO DI RICHERCHE IDRAULICHE, PADUA (ITALY).
Cartridge Magnetic Tape Incremental Recorder for Hydro-Meteorological Data Acquisition,
W72-04848 7A

PENNSYLVANIA FISH COMMISSION, BELLEFONTE. BENNER SPRING FISHERIES RESEARCH STATION.
Considerations for Conventional Trout Hatchery Design and Construction in Pennsylvania,
W72-04934 8I

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF ANIMAL SCIENCE.
Accumulations of Certain Pesticides in Adipose Tissues and Performance of Angus, Hereford, and Holstein Steers Fed Apple Processing Wastes,
W72-04992 5D

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF CIVIL ENGINEERING.
Phosphorus Removal - The State of the Art,
W72-05131 5D

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF MICROBIOLOGY.
Isolation and Counting of Athiorhodaceae with Membrane Filters,
W72-04743 5A

PERKIN-ELMER CORP., NORWALK, CONN.
Pesticide Residues, Infrared and Ultraviolet Spectra of Seventy-Six Pesticides,
W72-04738 5A

PLANUNGSABTEILUNG BUNDESKANZLERAMT, BONN, (WEST GERMANY).
Cooperation of Government, Science, and Industry in Research and Development - A Systems View,
W72-05075 6B

POLSKIE TOWARZYSTWO PRZYRODNKOW IM KOPERNIKA, WARSAW.
Th Role of Animals in Earth-Surface Modeling Processes,
W72-04876 2G

PORTLAND DEPT. OF PUBLIC WORKS, OREG. BUREAU OF SANITARY ENGINEERING.
Demonstration of Rotary Screening for Combined Sewer Overflows.
W72-04827 5D

POTTER (ALEXANDER) ASSOCIATION, NEW YORK.
Pumping Sludge Long Distances,
W72-05013 5D

PRAGUE DEPT. OF WATER TECHNOLOGY (CZECHOSLOVAKIA).
Biological and Bacteriological Evaluation of Pilot Plant Artificial Recharge Experiments,
W72-05143 4B

PRINCETON UNIV., N.J. DEPT. OF GEOLOGICAL AND GEOPHYSICAL SCIENCES.
A Geochemical Drainage Survey and Its Implications for Metallogenesis, Central Coast Mountains, British Columbia,
W72-04798 2K

PROCTOR AND GAMBLE CO., CINCINNATI, OHIO. ENVIRONMENTAL CONTROL SECTION.
Industrial Spill Control and Pollution Incident Prevention,
W72-05017 5G

PURDUE UNIV., LAFAYETTE, IND. AGRICULTURAL EXPERIMENT STATION.
A Comparison of Nitrogen Losses From Urea and Ammonium Nitrate in Surface Runoff Water,
W72-05142 5B

RAND CORP., SANTA MONICA, CALIF.
Where Will All the People Go. How Much Will They Dump When They Get There -- Population Distribution, Environmental Damage, and the Quality of Life,
W72-05123 6B

READING UNIV. (ENGLAND). DEPT. OF HORTICULTURE.
A Simple Wetness Recorder,
W72-05152 7B

RENSSELAER POLYTECHNIC INST., TROY, N.Y.
Bacteriology of Manganese Nodules: V. Effect of Hydrostatic Pressure on Bacterial Oxidation of MnII and Reduction of MnO2,
W72-05129 5C

RESEARCH COUNCIL OF ALBERTA, EDMONTON.
Groundwater Discharge: A Common Generator of Diverse Geologic and Morphologic Phenomena,
W72-04851 2F

RESEARCH INST. FOR WATER RESOURCES DEVELOPMENT, BUDAPEST (HUNGARY).
Seepage Through Saturated and Unsaturated Layers,
W72-05045 2G

REX CHAINBELT, INC., MILWAUKEE, WIS.
Process Evaluation--Phosphorus Removal,
W72-04979 5D

RHODE ISLAND UNIV., KINGSTON. NARRAGANSETT MARINE LAB.
Cultural Estimation of Yeasts on Seaweeds,
W72-04748 5A

RHODE ISLAND UNIV., KINGSTON. WATER RESOURCES CENTER.
Nuclear Energy for a New Town,
W72-05091 6G

RHODES UNIV., GRAHAMSTOWN (SOUTH AFRICA). DEPT. OF ZOOLOGY AND ENTOMOLOGY; AND WATERLOO UNIV. (ONTARIO). DEPT. OF BIOLOGY.
Use of 14C-Glucose to Study Substrate Removal by Activated Sludge,
W72-04970 5D

RIVKIN/CARSON, INC., WASHINGTON, D.C.
Population Growth in Communities in Relation to Water Resources Policy.
W72-04785 6B

ROAD RESEARCH LAB. CROWTHORNE (ENGLAND).
Rainfall and Run-off from an Industrial Area in Nairobi, Kenya,
W72-04837 4C

ROBERT S. KERR WATER RESEARCH CENTER, ADA, OKLA.
Probable Impact of NTA on Ground Water,
W72-04800 5B

ROME UNIV. (ITALY). INSTITUTO DI ZOOLOGIA.
Observations on the Plankton of the Port of Civitavecchia, (In Italian),
W72-05196 5C

ROTHAMSTED EXPERIMENTAL STATION, HARPENDEN (ENGLAND).
Woburn Irrigation, 1960-8: V. Results for Leys,
W72-04910 3F

Woburn Irrigation, 1960-8: VI. Results for Rotation Crops,
W72-04911 3F

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N.J.
The Effects of Column Height and Diameter on the Effectiveness of a Continuous Bubble Fractionation System,
W72-04921 5G

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N.J. COLL. OF AGRICULTURE AND ENVIRONMENTAL SCIENCE.
Composition of Surface Waters of New Jersey in Relation to Soil Series: II. Waters of the South Branch: Raritan River, Stony Brook, Neshanic River and Assumpink Creek,
W72-05198 5A

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, N.J. OYSTER RESEARCH LAB.
Accumulation and Elimination of Coliphage S-13 by the Hard Clam, Mercenaria Mercenaria,
W72-04953 5C

SALVI S.P.A., MILAN (ITALY); AND POLITECNICO DI MILANO (ITALY).
The Vibrations of Transmission Line Conductor Bundles,
W72-04863 8C

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CALIF.
A Modern Evaporite Deposit in Mexico,
W72-05161 2L

SEOUL NATIONAL UNIV. (REPUBLIC OF KOREA). DEPT. OF BOTANY.
A Study on the Brackish Water Type on the Han River Estuary (In Korean),
W72-05203 2L

SHEFFIELD UNIV. (ENGLAND).
The Load Movement Behavior of Long Piles,
W72-04872 8D

SHELL DEVELOPMENT CO., EMERYVILLE, CALIF.
The Response of Substation Bus Systems to Short Circuit Conditions: Part I, II, III,
W72-04862 8C

SHELL RESEARCH LTD., SITTINGBOURNE (ENGLAND). TUNSTALL LAB.
Residues of Polychlorobiphenyls in Biological Samples,
W72-04754 5A

SHELLFISH LAB., BRINNON, WASH.
The Oyster Producing Potential of Puget Sound,
W72-04725 2I

SHINSHU UNIV., MATSUMOTO (JAPAN). DEPT. OF GEOGRAPHY.
An Investigation on Slope Erosion by Meltwater of Snow-Patches in Mt. Gassan, (In Japanese),
W72-05218 2J

SIERRA CLUB, ALBUQUERQUE, N. MEX.
The Primacy of our Environment over the Economy,
W72-04887 6B

SOIL CONSERVATION SERVICE, PORTLAND, OREG.
Evaluating Multiple Economic Effects of Forage Development and Management,
W72-05104 4A

SOUTH DAKOTA STATE UNIV., BROOKINGS. DEPT. OF PLANT SCIENCE.
Soil-Desiccation Features in South Dakota Depressions,
W72-04812 2G

SOUTHERN COLORADO STATE COLL., PUEBLO.
Ecology of Heterotrophic Aerobic Bacteria of Playa Lakes and Microcosms,
W72-04905 5C

SOUTHWEST TEXAS STATE UNIV., SAN MARCOS. DEPT. OF BIOLOGY.
Some Effects of Temperature and Oxygen Concentration on Phyllopod Ecology,
W72-04988 5C

SOUTHWESTERN GREAT PLAINS RESEARCH CENTER, BUSHLAND, TEX.
Growth Patterns of Irrigated Sugarbeet Roots and Tops,
W72-04915 3F

Herbicides in Narrow-Row Cotton Culture,
W72-05233 3F

STANFORD UNIV., PACIFIC GROVE, CALIF. HOPKINS MARINE STATION.
Diurnal Rhythms in Netplankton and Nannoplankton Assimilation Ratios,
W72-04770 5C

STATE UNIV., ALBANY, NEW YORK.
Snowfall From Lake-Effect Storms,
W72-04845 2B

STATION CENTRALE DE PHYSIOLGIE ANIMALE, JOUY-EN-JOSAS (FRANCE).
Sterilization of the Testicles of Guppies by Means of Non-Lethal Doses of Parathion (In French),
W72-05191 5C

STATION D'HYDROBIOLOGIE CONTINENTALE, BIARRITZ (FRANCE).
Ecology and the Repopulation of Trout Streams,
W72-05268 2I

STAZIONE ZOOLOGICA DE NAPOLI (ITALY).
Hydrographic Notes on Some Peripheral Tributaries of the Lagoon of Fusaro, (In Italian),
W72-05199 2L

STELLENBOSCH UNIV. (SOUTH AFRICA).
Fluoridation: The Past 25 Years,
W72-05235 5F

STOCKHOLM UNIV. (SWEDEN). ASKO LAB.; AND STOCKHOLM UNIV. (SWEDEN). DEPT. OF ZOOLOGY.
A Quantitative Plankton Sampler,
W72-04713 7B

STRAND (JOHN A.) AND ASSOCIATES, INC., MADISON, WIS.
Inland Lake Dredging Evaluation.
W72-04778 8C

TASMANIA UNIV., HOBART (AUSTRALIA). DEPT. OF BOTANY.
Hyphomicrobia and the Oxidation of Manganese in Aquatic Ecosystems,
W72-05197 5A

TECHNION-ISRAEL INST. OF TECH., HAIFA. SCHOOL OF ENGINEERING.
An Intersectoral Programming Model for the Management of the Waste Water Economy of the San Francisco Bay Region,
W72-04780 5B

TECHNISCHE HOGESCHOOL, DELFT (NETHERLANDS). DEPT. OF CIVIL ENGINEERING.
The Measurement of Small Soil Displacements on a Dutch Hillslope,
W72-05040 2G

TECHNISCHE UNIVERSITAET, HANOVER (WEST GERMANY). INSTITUT FUER BODENKUNDE.
Results of Hydraulic Conductivity Measurements in the Unsaturated State (In German),
W72-04781 2G

TEL-AVIV UNIV. (ISRAEL). DEPT. OF BOTANY.
The Effect of Epidermal Cell Water Potential on Stomatal Response to Illumination of Leaf Discs of Vicia faba,
W72-05240 2I

TEL AVIV UNIV. (ISRAEL). DEPT. OF ENVIRONMENTAL SCIENCES.
Thermal Mapping of Selected Sites in the Lake Kinneret Region,
W72-04811 7B

TOKYO METROPOLITAN UNIV. (JAPAN).
Distribution of Heterotrophic Bacteria and Their Possible Role in the Mineralization of Organic Matter in Yuno-Ko, A Mesotrophic Lake,
W72-05160 5C

TORONTO UNIV. (ONTARIO). DEPT. OF GEOGRAPHY.
Agricultural Flood Damage Assessment: A Review and Investigation of a Simulation Method,
W72-04877 6F

TORONTO UNIV. (ONTARIO). DEPT. OF ZOOLOGY.
The Study of Evaporation from Small Surfaces by the Direct Measurement of Water Vapor Pressure Gradients,
W72-04925 2D

U.S. SENATE, WASHINGTON, D.C.
Environmental Policy and the Congress,
W72-05118 6E

UNIV. SASKATCHEWAN, SASKATOON, SASK., CAN. BIOL. DEP.
Limnological Studies of the Lakes and Streams of the Upper Qu,Appelle River System, Saskatchewan, Canada: I. Chemical and Physical Aspects of the Lakes and Drainage System,
W72-04975 5C

UNIVERSIDAD NACIONAL DEL SUR, BAHIA BLANCA (ARGENTINA).
Intermittent Leaching, A Recommended Technique for the Reclamation of Saline Soils, (In Spanish),
W72-05228 2G

UNIVERSITY OF THE WEST INDIES, ST. AUGUSTINE (TRINIDAD). DEPT. OF BIOLOGICAL SCIENCES.
Studies on the Biology and Cultivation of the Mangrove Oyster in Trinidad with Notes on Other Shellfish Resources,
W72-05172 2L

UPPSALA UNIV. (SWEDEN). INST. OF ZOOLOGY.
A Simplified Tube Bottom Sampler,
W72-04715 7B

USTAV EPIDEMIOLOGIE A MIKROBIOLOGIE, PRAGUE (CZECHOSLOVAKIA).
Virological Surveys of the Presence of Enteroviruses in Waste Water: I. Incidence of Polio-viruses in Prague at the End of 1963 and in 1969, (In Czech),
W72-05226 5B

UTAH STATE UNIV., LOGAN.
Plant Growth-Evapotranspiration Relations for Several Crops in the Central Great Plains,
W72-05147 2D

UTAH STATE UNIV., LOGAN. COLL. OF ENGINEERING.
Development of a Procedure for Determining Spacial and Time Variations of Precipitation in Venezuela,
W72-04804 2B

Finite Difference Solutions of Axisymmetric Infiltration Through Partially Saturated Porous Media,
W72-04805 2G

Analysis of Colombian Precipitation to Estimate Irrigation Requirements,
W72-04806 2B

Inverse Solutions to Three-Dimensional Free Surface Potential Flows,
W72-04808 2F

Development of Cold Cloud Seeding Technology for Use in Precipitation Management,
W72-04836 3B

UTAH STATE UNIV., LOGAN. DEPT. OF RANGE SCIENCE.
The Effect of Wind on Stomatal Aperture, Photosynthesis, and Transpiration of Rhododendron ferrugineum L. and Pinus cembra L.,
W72-05108 2I

Woody Phreatophyte Infestation of the Middle Brazos River Floodplain,
W72-05231 3B

UTAH STATE UNIV., LOGAN. DEPT. OF SOCIOLOGY.
Some Social Issues and Alternatives Involved in Planning Water Resources with People in the West,
W72-04889 6B

UTAH STATE UNIV., LOGAN. DEPT. OF SOIL SCIENCE AND BIOMETEOROLOGY.
Cation Adsorption in One-Dimensional Flow Through Soils: A Numerical Solution,
W72-05031 2G

UTAH STATE UNIV., LOGAN. DEPT. OF SOILS AND METEOROLOGY.
Advection and Evapotranspiration of Wide-row Sorghum in the Central Great Plains,
W72-05186 2D

UTAH STATE UNIV., LOGAN. DEPT. OF WILDLIFE RESOURCES.
Comparison of Some Species Importance Values and Ordination Techniques Used to Analyse Benthic Invertebrate Communities,
W72-04716 5A

VANDERBILT UNIV., NASHVILLE, TENN. DEPT. OF ENVIRONMENTAL AND WATER RESOURCES ENGINEERING.
Dual Substrate Utilization by Activated Sludge Microflora,
W72-04990 5D

VERMONT UNIV., BURLINGTON. DEPT. OF CIVIL ENGINEERING.
A Method for Predicting Peak Flows From Small Rural Vermont Watersheds,
W72-04897 8B

VIRGINIA INST. OF MARINE SCIENCE, GLOUCESTER POINT.
Groundwater Flow in a Sandy Tidal Beach: Two-Dimensional Finite Element Analysis,
W72-05033 2F

VIRGINIA INST. OF MARINE SCIENCE, WACHAPREAGUE.
Rearing the Bay Scallop, Aequipecten Irradians,
W72-04724 2I

VOLCANI INST. OF AGRICULTURE RESEARCH, BET-DAGAN (ISRAEL).
Effects of Soil Moisture Stress on Two Varieties of Upland Cotton in Israel: II. The Northern Negev Region,
W72-05180 3F

VSESOYUZNYI NAUCHNO-ISSLEDOVATELSKII INSTITUT VODOSNABZHENIYA, KANALIZATSKII, GIDROTEKHNICHESKIKH SOORUZHENII I INZHENERNOI GIDROGEOLOGII, MOSCOW (USSR).
Long-Term Water-Quality Characteristics of the Bratsk Reservoir and Forecast of Organic Matter Accumulation (Mnogoletnyaya kharakteristika formirovaniya kachestva vody i prognoz nakopleniya organicheskogo veshchestva v Bratskom vodok hranilishche),
W72-04859 5C

VSESOYUZNYI NEFTEGAZOVYI NAUCHNO-ISSLEDOVATELSKII INSTITUT, MOSCOW (USSR).
Hydrogeology and Hydrodynamics of Groundwater (Gidrogeologiya i gidrodinamika podzemnykh vod),
W72-04832 2F

WASHINGTON STATE PLANNING AND COMMUNITY AFFAIRS AGENCY, OLYMPIA.
A New Dimension of State Planning -- Policy Development and Issue Analysis,
W72-05052 6E

WASHINGTON STATE UNIV., PULLMAN. COLL. OF ENGINEERING RESEARCH DIV.
Trace Element Analysis of Environmental Samples by Neutron Activation Method,
W72-04998 5A

WASHINGTON UNIV., SEATTLE. COLL. OF FISHERIES.
Oxytetracycline Efficacy as a Pretreatment Against Columnaris and Furunculosis in Coho Salmon,
W72-04930 5C

WASHINGTON UNIV., SEATTLE. DEPT. OF CIVIL ENGINEERING.
Toxicity of Seawater to Coliform Bacteria,
W72-04757 5C

WASHINGTON UNIV., SEATTLE. SCHOOL OF LAW.
Groundwater Law, Management and Administration,
W72-05101 6E

WASHINGTON UNIV., SEATTLE. WATER BIOLOGY.
The Total Organic Carbon Analyzer and Its Application to Water Research,
W72-05001 5A

WATER PLANNING FOR ISRAEL LTD, TEL AVIV (ISRAEL).
The Use of Non-Dimensional One-Parameter Functions For The Determination of Regional Rainfall Depth-Duration-Frequency Relations,
W72-05047 2A

WATER RESOURCES COUNCIL, WASHINGTON, D.C.
A Look Ahead in Planning Coordination and Policy Making,
W72-04884 6B

WATERLOO UNIV. (ONTARIO). DEPT. OF CHEMISTRY.
ESCA--The New Spectroscopy,
W72-05051 2K

WESTERN MICHIGAN UNIV., KALAMAZOO. DEPT. OF GEOLOGY.
Coastal Sedimentation of Southeastern Lake Michigan, Field Trip Guidebook,
W72-04807 2J

WESTERN STATES WATER COUNCIL, PORTLAND, OREG.
A Review of Inter-Regional and International Water Transfer Proposals,
W72-04883 6B

WESTINGHOUSE ELECTRIC CORP., EAST PITTSBURGH, PA.
Incremental Voltage Uprating of Transmission Lines,
W72-04864 8C

WESTON (ROY F.), INC., WEST CHESTER, PA.
Operation of Conventional Activated Sludge for Maximum Phosphorus Removal,
W72-04978 5D

WILLIAMS AND WORKS, GRAND RAPIDS, MICH.
The Use, Abuse and Recovery of a Glacial Aquifer,
W72-04802 5B

WISCONSIN UNIV., MADISON. COLL. OF AGRICULTURAL AND LIFE SCIENCES.
Economical Radiometer Theory, Performance and Construction,
W72-05081 2D

WISCONSIN UNIV., MADISON. DEPT. OF CIVIL ENGINEERING.
Identification of Filamentous Microorganisms in Activated Sludge,
W72-04984 5B

WISCONSIN UNIV., MADISON. DEPT. OF ENTOMOLOGY.
Phenylmercuric Acetate: Metabolic Conversion by Microorganisms,
W72-05138 5C

WISCONSIN UNIV., MADISON. DEPT. OF FORESTRY.
The Response of Transpiration Resistance to Leaf Temperature as a Desiccation Resistance Mechanism in Tree Seedlings,
W72-05244 2D

WISCONSIN UNIV., MADISON. DEPT. OF SOIL SCIENCE.
Levels of Inorganic and Total Phosphorus in Lake Sediments as Related to Other Sediment Parameters,
W72-04732 5C

Cation Exchange Selectivity of Some Clay-Sized Minerals and Soil Materials,
W72-05127 2K

WISCONSIN UNIV., MADISON. WATER CHEMISTRY LAB.
Denitrification as a Nitrogen Sink in Lake Mendota, Wisconsin,
W72-05130 5B

WISCONSIN UNIV., MADISON. WATER CHEMISTRY PROGRAM.
Method For the Storage of Samples For Dissolved Gas Analyses,
W72-04729 5A

Selenium in Lake Sediments - Analytical Procedure and Preliminary Results,
W72-04733 5A

Forms of Inorganic Nitrogen in Domestic Wastewater,
W72-04981 5A

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.
Annual Phytoplankton Cycle of the Cape Fear River Estuary, North Carolina,
W72-04902 2L

Effects of Phosphorus Mining Wastes on the Growth of Phytoplankton in the Pamlico River Estuary,
W72-04906 5C

WORLD HEALTH ORGANIZATION, TAIPEI (TAIWAN).
The Microclimate of Simulated Burrows of Bandicota bengalensis (G and H.) in Calcutta, India (Rodentia:Muridae),
W72-05273 2I

YALE UNIV., NEW HAVEN, CONN. DEPT. OF BIOLOGY.
Ianula: An Account of the History and Development of the Lago Di Monterosi, Latium, Italy: XIII. The History of the Lake: A Synthesis,
W72-05209 5C

ZAGREB UNIV. (YUGOSLOVIA). FACULTY OF AGRICULTURE.
Results of Complex Investigations Relating to the Influence of Soil Moisture, Fertilizing with N, Sowing Density and Year, Singly and Interacting, in Wheat Production (In Croatian),
W72-05177 3F

ZAVOD ZA RIBARSTVO, SKOPLJE (YUGOSLAVIA).
Acclimatization of the Israeli Carp in Lake Dojran (Macedonia), Yugoslavia,
W72-05267 2H

ACCESSION NUMBER INDEX

W72-04704 5D
W72-04705 2L
W72-04706 2H
W72-04707 8I
W72-04708 5A
W72-04709 5C
W72-04710 5A
W72-04711 5D
W72-04712 2I
W72-04713 7B
W72-04714 5A
W72-04715 7B
W72-04716 5A
W72-04717 5C
W72-04718 5C
W72-04719 5B
W72-04720 5A
W72-04721 2I
W72-04722 2I
W72-04723 2I
W72-04724 2I
W72-04725 2I
W72-04726 5A
W72-04727 5B
W72-04728 2I
W72-04729 5A
W72-04730 5A
W72-04732 5C
W72-04733 5A
W72-04734 5D
W72-04735 5A
W72-04736 5B
W72-04737 5C
W72-04738 5A
W72-04739 5A
W72-04740 5A
W72-04741 5A
W72-04742 5A
W72-04743 5A
W72-04744 2I
W72-04745 5A
W72-04746 5F
W72-04747 8C
W72-04748 5A
W72-04749 7B
W72-04750 7B
W72-04751 7B
W72-04752 7C
W72-04753 5B
W72-04754 5A
W72-04755 2I
W72-04756 2I
W72-04757 5C
W72-04758 6B
W72-04759 5C
W72-04760 6A
W72-04761 5C
W72-04762 5B
W72-04763 5C
W72-04764 5C
W72-04765 5C
W72-04766 5C
W72-04767 2H
W72-04768 2H
W72-04769 5C
W72-04770 5C
W72-04771 2H
W72-04772 2L
W72-04773 5C
W72-04774 5C
W72-04775 8I
W72-04776 5C
W72-04777 2J
W72-04778 8C
W72-04779 6A
W72-04780 5B
W72-04781 2G
W72-04782 7B
W72-04783 2G
W72-04784 5D
W72-04785 6B
W72-04786 6E
W72-04787 5D
W72-04788 5D
W72-04789 5D
W72-04790 2I
W72-04791 5C
W72-04792 5B
W72-04793 5G
W72-04794 2J
W72-04795 4B
W72-04796 2F
W72-04797 2E
W72-04798 2K
W72-04799 5B
W72-04800 5B
W72-04801 5B
W72-04802 5B
W72-04803 5B
W72-04804 2B
W72-04805 2G
W72-04806 2B
W72-04807 2J
W72-04808 2F
W72-04809 8B
W72-04810 2J
W72-04811 7B
W72-04812 2G
W72-04813 2J
W72-04814 2K
W72-04815 4A
W72-04816 6D
W72-04817 2L
W72-04818 7B
W72-04819 4B
W72-04820 4B
W72-04821 4A
W72-04822 7C
W72-04823 4B
W72-04824 5B
W72-04825 5D
W72-04826 5G
W72-04827 5D
W72-04828 5G
W72-04829 5D
W72-04830 5D
W72-04831 5D
W72-04832 2F
W72-04833 4A
W72-04834 2H
W72-04835 2K
W72-04836 3B
W72-04837 4C
W72-04838 2L
W72-04839 6A
W72-04840 4B
W72-04841 7C
W72-04842 5A
W72-04843 2K
W72-04844 4C
W72-04845 2B
W-72 04846 2A
W72-04847 2A
W72-04848 7A
W72-04849 4B
W72-04850 2F
W72-04851 2F
W72-04852 2E
W72-04853 2H
W72-04854 2H
W72-04855 5C
W72-04856 2H
W72-04857 2H
W72-04858 2H
W72-04859 5C
W72-04860 5C
W72-04861 4A
W72-04862 8C
W72-04863 8C
W72-04864 8C
W72-04865 8A
W72-04866 6B
W72-04867 8C
W72-04868 8C
W72-04869 8G
W72-04870 8A
W72-04871 8B
W72-04872 8D
W72-04873 7B
W72-04874 8C
W72-04875 4A
W72-04876 2G
W72-04877 6F
W72-04878 6B
W72-04879 6B
W72-04880 6B
W72-04881 6B
W72-04882 6B
W72-04883 6B
W72-04884 6B
W72-04885 6B
W72-04886 6B
W72-04887 6B
W72-04888 6B
W72-04889 6B
W72-04890 6B
W72-04891 6B
W72-04892 6B
W72-04893 6B
W72-04894 6B
W72-04895 6B
W72-04896 2E
W72-04897 8B
W72-04898 6G
W72-04899 2G
W72-04900 5A
W72-04901 5A
W72-04902 2L
W72-04903 2L
W72-04904 2L
W72-04905 5C
W72-04906 5C
W72-04907 2D
W72-04908 5G
W72-04909 5C
W72-04910 3F
W72-04911 3F
W72-04912 2H
W72-04913 2H
W72-04914 5A
W72-04915 3F
W72-04916 3F
W72-04917 3F
W72-04918 3F
W72-04919 5D
W72-04920 5B
W72-04921 5G
W72-04922 5B
W72-04923 5B
W72-04924 2G
W72-04925 2D
W72-04926 3F
W72-04927 5C
W72-04928 5C
W72-04929 5C
W72-04930 5C
W72-04931 5C
W72-04932 5C
W72-04933 5C
W72-04934 8I
W72-04935 5C
W72-04936 6B
W72-04937 5D
W72-04938 6B
W72-04939 5C
W72-04940 5C
W72-04941 5C
W72-04942 5C
W72-04943 5C
W72-04944 5C
W72-04945 5C
W72-04946 5A
W72-04947 5A
W72-04948 5A
W72-04949 5D
W72-04950 5F
W72-04951 6D
W72-04952 5A
W72-04953 5C
W72-04954 3B
W72-04955 4D
W72-04956 6B
W72-04957 5C
W72-04958 5C
W72-04959 5B
W72-04960 5C
W72-04961 3F
W72-04962 4A
W72-04963 5C
W72-04964 5A
W72-04965 5E
W72-04966 2B
W72-04967 5D
W72-04968 5D
W72-04969 5F
W72-04970 5D
W72-04971 5D
W72-04972 5D
W72-04973 5D
W72-04974 5B
W72-04975 5C
W72-04976 5D
W72-04977 5D
W72-04978 5D
W72-04979 5D
W72-04980 6B
W72-04981 5A
W72-04982 5A
W72-04983 5D
W72-04984 5B
W72-04985 6B
W72-04987 2E
W72-04988 5C
W72-04989 5D
W72-04990 5D
W72-04991 5D
W72-04992 5D
W72-04993 5D
W72-04994 5D
W72-04995 5D
W72-04996 5D
W72-04997 5A
W72-04998 5A
W72-04999 5A
W72-05000 5C
W72-05001 5A
W72-05002 5D
W72-05003 2H
W72-05004 5D
W72-05005 5D
W72-05006 5D
W72-05007 2D
W72-05008 7B
W72-05009 5C
W72-05010 5D
W72-05011 5D
W72-05012 5A
W72-05013 5D
W72-05014 5D
W72-05015 5D
W72-05016 5D
W72-05017 5G

W72-05018 5D
W72-05019 5D
W72-05020 2H
W72-05021 6B
W72-05022 5D
W72-05023 5C
W72-05024 5C
W72-05025 7C
W72-05026 2B
W72-05027 5B
W72-05028 7C
W72-05029 7A
W72-05030 2A
W72-05031 2G
W72-05032 2F
W72-05033 2F
W72-05034 6A
W72-05035 4C
W72-05036 4A
W72-05037 2J
W72-05038 2K
W72-05039 2E
W72-05040 2G
W72-05041 5D
W72-05042 7B
W72-05043 2K
W72-05044 4B
W72-05045 2G
W72-05046 2A
W72-05047 2A
W72-05048 2B
W72-05049 7B
W72-05050 8B
W72-05051 2K
W72-05052 6E
W72-05053 2G
W72-05054 5D
W72-05055 5E
W72-05056 5A
W72-05057 5D
W72-05058 5E
W72-05059 5E
W72-05060 5E
W72-05061 5E
W72-05062 5E
W72-05063 5E
W72-05064 5E
W72-05065 5E
W72-05066 5E
W72-05067 5B
W72-05068 5B
W72-05069 5A
W72-05070 5A
W72-05071 5B
W72-05072 5A
W72-05073 5D
W72-05074 5D
W72-05075 6B
W72-05076 3B
W72-05077 2D
W72-05078 4A
W72-05079 2D
W72-05080 2A
W72-05081 2D
W72-05082 6B
W72-05083 6E
W72-05084 6B
W72-05085 5C
W72-05086 5D
W72-05087 5C
W72-05088 7C
W72-05089 2G
W72-05090 5C
W72-05091 6G
W72-05092 5C
W72-05093 3E
W72-05094 7C
W72-05095 7C
W72-05096 7C
W72-05097 6E
W72-05098 6E
W72-05099 6E
W72-05100 6E
W72-05101 6E
W72-05102 2I
W72-05103 5B
W72-05104 4A
W72-05105 3F
W72-05106 3F
W72-05107 2H
W72-05108 2I
W72-05109 5A
W72-05110 7B
W72-05111 5F
W72-05112 2L
W72-05113 5A
W72-05114 5C
W72-05115 5F
W72-05116 2G
W72-05117 2I
W72-05118 6E
W72-05119 6A
W72-05120 5B
W72-05121 6B
W72-05122 2G
W72-05123 6B
W72-05124 2G
W72-05125 5D
W72-05126 2G
W72-05127 2K
W72-05128 2G
W72-05129 5C
W72-05130 5B
W72-05131 5D
W72-05132 6E
W72-05133 6B
W72-05134 5C
W72-05135 2G
W72-05136 2D
W72-05137 2G
W72-05138 5C
W72-05139 2G
W72-05140 5D
W72-05141 2G
W72-05142 5B
W72-05143 4B
W72-05144 2D
W72-05145 2G
W72-05146 5G
W72-05147 2D
W72-05148 5B
W72-05149 2D
W72-05152 7B
W72-05153 3F
W72-05154 2I
W72-05155 2G
W72-05156 4D
W72-05157 2H
W72-05158 5B
W72-05160 5C
W72-05161 2L
W72-05162 2L
W72-05163 2C
W72-05164 5C
W72-05165 5C
W72-05166 2H
W72-05167 2B
W72-05168 2B
W72-05169 5C
W72-05171 3F
W72-05172 2L
W72-05173 2H
W72-05174 3F
W72-05175 2H
W72-05176 2I
W72-05177 3F
W72-05178 2G
W72-05179 3F
W72-05180 3F
W72-05181 2H
W72-05182 3F
W72-05183 2B
W72-05184 3F
W72-05185 3F
W72-05186 2D
W72-05187 3F
W72-05188 3F
W72-05189 5A
W72-05190 3F
W72-05191 5C
W72-05193 2I
W72-05194 2K
W72-05196 5C
W72-05197 5A
W72-05198 5A
W72-05199 2L
W72-05200 2H
W72-05201 5C
W72-05203 2L
W72-05205 2H
W72-05206 5C
W72-05207 5C
W72-05208 5C
W72-05209 5C
W72-05210 5A
W72-05211 2L
W72-05212 2L
W72-05213 2L
W72-05214 5C
W72-05215 5C
W72-05217 3F
W72-05218 2J
W72-05219 5C
W72-05220 2L
W72-05221 2I
W72-05222 2I
W72-05223 3F
W72-05224 5G
W72-05225 5C
W72-05226 5B
W72-05227 5A
W72-05228 2G
W72-05229 3F
W72-05230 4A
W72-05231 3B
W72-05232 3F
W72-05233 3F
W72-05234 2G
W72-05235 5F
W72-05236 5C
W72-05237 5B
W72-05239 3F
W72-05240 2I
W72-05241 2D
W72-05242 3F
W72-05243 2I
W72-05244 2D
W72-05245 3F
W72-05246 2I
W72-05247 4A
W72-05248 5C
W72-05249 5C
W72-05250 3F
W72-05251
W72-05252 3F
W72-05253 2D
W72-05254 5A
W72-05255 2L
W72-05256 7B
W72-05257 2L
W72-05258 5C
W72-05259 2L
W72-05260 2I
W72-05262 2I
W72-05263 2I
W72-05264 2H
W72-05265 2I
W72-05266 2I
W72-05267 2H
W72-05268 2I
W72-05270 2I
W72-05271 2I
W72-05272 2I
W72-05273 2I
W72-05274 2I
W72-05275 2I
W72-05276 2I
W72-05277 2I
W72-05278 2I
W7204731 5A

ABSTRACT SOURCES

Source	Accession Number	Total
A. Centers of Competence		
Batelle Memorial Institute, Methods for Chemical and Biological Identification of Pollutants	W72-04710 -- 04711 04713 -- 04720 04726 -- 04727 04729 -- 04743 04745 -- 04749 04753 -- 04754	34
Iowa State University, Agricultural Livestock Wastes	W72-05054 -- 05074	21
Cornell University, Policy Models for Water Resources Systems	W72-04779 -- 04780	2
University of Wisconsin, Eutrophication	W72-04759 04761 -- 04763 04765 -- 04766 04769 -- 04770 04773 -- 04774 04776, 04778	12
University of Texas, Wastewater Treatment and Management	W72-04787 -- 04789 04825 -- 04827 04967 -- 04974 04976 -- 04979 04981 04983 -- 04984 04989 -- 04996 04998 05001 -- 05002 05004 -- 05006 05010 -- 05019	45
U. S. Geological Survey, Hydrology	W72-04790 -- 04824 04832 -- 04838 04840 -- 04861 05024 -- 05040 05042 -- 05051 05053 05094 -- 05096	95
Colorado State University, Irrigation Return Flow Quality	W72-05120, 05124 05127 05130 -- 05131 05136 05139 -- 05140 05142 -- 05145 05147 -- 05149	15
Bureau of Reclamation, Engineering Works	W72-04862 -- 04875	14
University of Wisconsin, Water Resources Economics	W72-04877 04879 -- 04895	18
University of Chicago, Metropolitan Water Resources Management	W72-04758, 04760 04839, 04936 04938, 04956 04980, 04985 05021, 05052 05075 05082 -- 05084 05118 -- 05119 05121, 05123 05132 -- 05133	20

ABSTRACT SOURCES

Source	Accession Number	Total
B. State Water Resources Research Institutes		
Oklahoma Water Resources Research Institute	W72-04784	1
Colorado Environmental Resources Center	W72-04878	1
Vermont Resources Research Center	W72-04897	1
California Water Resources Center	W72-04898 -- 04899	2
Massachusetts Water Resources Research Center	W72-05088, 05092	2
Kansas Water Resources Research Institute	W72-05089	1
Oregon Water Resources Research Institute	W72-05090	1
Rhode Island Water Resource Center	W72-05091	1
New Mexico Water Resource Research Institute	W72-05093	1
C. Other		
BioSciences Information Service	W72-04705 -- 04707 04712 04721 -- 04725 04728, 04744 04750 -- 04752 04755 -- 04757 04764 04767 -- 04768 04771 -- 04772 04775, 04777 04781 -- 04782 04790, 04876 04902 -- 04935 04937 04939 -- 04955 04957 -- 04964 04975, 04982 04987 -- 04988 04997 04999 -- 05000 05003 05007 -- 05009 05020, 05023 05085 05102 -- 05117 05122 05125 -- 05126 05128 -- 05129 05134 -- 05135	245

ABSTRACT SOURCES

Source	Accession Number	Total
C. Other (Cont'd)		
BioSciences Information Service (Cont'd)	W72-05137 -- 05138 05141 05152 -- 05158 05160 -- 05169 05171 -- 05191 05193 -- 05194 05196 -- 05201 05203 05205 -- 05215 05217 -- 05237 05239 -- 05260 05262 -- 05268 05270 -- 05278	
Environmental Protection Agency	W72-04704 04708 -- 04709 04828 -- 04831 04901, 04965	9
Office of Water Resources Research	W72-04783, 04896 04966	3
National Water Commission	W72-04785 -- 04786 05097 -- 05101	7
Forest Service	W72-05076 -- 05081	6
Coastal Plains Center for Marine Development Services	W72-05086 -- 05087	2
Ocean Engineering Information Service	W72-05022, 05041	2

☆ U. S. GOVERNMENT PRINTING OFFICE : 1972 O-LT - 481-639 (19)

CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U. S. Geological Survey, U. S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the Soap and Detergent Association and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water-related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Public water supply treatment technology at the American Water Works Association.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural livestock wastes at the Department of Agricultural Engineering of Iowa State University.
- Methods for chemical and biological identification and measurement of pollutants at the Analytical Quality Control Laboratory of the Environmental Protection Agenc
- Coastal pollution at the Oceanic Research Institute.
- Water treatment plant waste pollution control at American Water Works Association.
- Effect on water quality of irrigation return flows, at the Department of Agricultural Engineering of Colorado State University.

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service
Springfield, Va. 22151

OFFICIAL BUSINESS

PRINTED MATTER

U.S.MAIL

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF COMMERCE

LIBRARY
MAY 31 1972
PACIFIC POWER & LIGHT COMPANY